Does preschool experience matter? : the relevance of preschool education and home activities for children's cognitive and social development at school entry in rural China

Does Preschool Experience Matter?

The Relevance of Preschool Education and Home Activities for Children's Cognitive and Social Development at School Entry in Rural China

By

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Declaration

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Candidate ________________________

Supervisor ________________________

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Date ________________________

Abstract

There has been growing interest in early childhood education and care (ECEC) globally, especially with respect to the possible benefits upon child wellbeing. In China, the government also has put great efforts recently in boosting preschool centre participation nationwide. The urban-rural disparities in the ECEC development, however, are great challenges. Moreover, little is known about the quality of these centre –based preschool programmes, especially in rural areas. Accumulating evidence from studies worldwide, largely from Western countries, indicates that high quality centre-based preschool programmes can be beneficial for child wellbeing. However, the cultural context is an issue of concern. This thesis investigates the relevance of aspects of home and preschool centre environments for children's cognitive and social development at preschool, measured one year before school entry (*Phase 1*), and later at school entry (*Phase 2*). The sample included 298 children (Mean age = 69 months, 151 girls) and families clustered in 19 preschool centres from rural China.

Multilevel models were applied to the hierarchical data and these multilevel analyses revealed that, less than 10% of the variations in cognitive and social outcomes at school entry were attributable to the preschool-centre differences. After accounting for selected background factors, preschool home activities were relevant to various aspects of cognitive and social development during preschool and at school entry; home activities appeared to be more relevant to social development. Positive associations were found between preschool centre quality (based on ECERS-R and ECERS-E), teachers' qualifications and developmental outcomes both at preschool and at school entry; preschool centre experience appeared to be more relevant to cognitive development and teacher-report behaviour outcomes. In summary, while child and family background factors such as age, gender, family income and parental education are important, the extent of home activities in the preschool years and preschool centre experience may both exert an independent influence upon children's cognitive and social development before school entry. These findings highlight the importance of higher quality of preschool centre experience and a better home learning environment for child development at school entry in rural China.

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Chapter 1 Introduction

1.1 Background

There has been growing interest in early childhood education and care globally, especially with respect to the possible benefits upon child wellbeing (Barnett, 1993, 2011; Heckman, 2006, 2011; Montie, Xiang, & Schweinhart, 2006; Phillips & Lowenstein, 2011; Reynolds, 2000; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004; Zigler, Gilliam, & Jones, 2006). The development of early childcare and education has become an important policy focus of governments' strategies for improving the wellbeing of children in many OECD (Organisation for Economic Co-operation and Development) countries such as Denmark, France and the UK.

On the one hand, the investments into early childcare and education services are enabling parents, especially women, to work in an increasingly demanding labour market, which in turn might be good for both the economy and the family. On the other hand, accumulating evidence from developmental psychology, education and neuroscience research has suggested that high quality early experience is crucially important for the wellbeing of children, including physical health, cognitive and social development, language development, as well as brain development, while inadequate stimulations and deprived environments may harm child development in the preschool years and later in childhood (Anisman, Zaharia, Meaney, & Merali, 1998; Barnett, 2011; Blau & Currie, 2006; Camilli, Vargas, Ryan, & Barnett, 2010; Fox, Levitt, & Nelson, 2010; Heckman & Masterov, 2007; Hertzman, 1999; Nelson & Bloom, 1997; Nelson, Furtado, Fox, & Zeanah, 2009; NICHD Early Child Care Research Network (ECCRN), 2000, 2005b; Reynolds, Temple, Ou, Arteaga, & White, 2011; Shonkoff, 2011; Shonkoff & Phillips, 2000; Sylva, Melhuish, Sammons, Siraji-Blatchford, & Taggart, 2010; Wilkinson & Marmot, 2003; Windsor, Glaze, Koga, & the BEIP core group, 2007).

Furthermore, economists from developed countries, especially in the US, have long argued that investments into early years services, especially in the first five years for disadvantaged children, can be more rewarding economically than investment in later years of life, based on cost-benefit analysis of early childcare and education programmes (Barnett, 1993; Belfield, Nores, Barnett, & Schweinhart, 2006; Blau, 2001; Cost, Quality, and Child Outcomes Study Team,1995; Gertler et al., 2014; Heckman, 2006; Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010a, 2010b; Karoly & Bigelow, 2005; Lynch, 2004; Masse & Barnett, 2002; Reynolds, Temple, Robertson, & Mann, 2002; Reynolds, Temple, White, Ou, & Robertson, 2011). Consequently, the generalizability of the evidence for policy recommendations nowadays is much stronger than decades ago.

In China, the early childcare and education (ECEC) services usually occur at childcare centre or nurseries for children under age 3 and at preschool or kindergarten provisions for children aged 3 to 6 years. The public investment and attention to development of ECEC service in China has increased as a result of the rapid economic growth since the 1980s (Zhou, 2011). With the combined efforts from the public and the government, the participation in preschool or kindergarten programmes in China has been growing steadily in the last decade (see Figure 1.1).

However, centre-based preschool services for 3-6 year olds in China are not part of the universal education system with patchy provision and centre-based childcare service for children under age 3 are even less inadequate (Corter, Janmohammed, Zhang, & Bertrand, 2006; Zhou, 2011). Furthermore, the regional and social economic disparities in the development of ECEC have been widely acknowledged in China and there is growing concern that the inequality in early years may lead to inequality in education at schools and even further social injustice in the future (Ye, 2010; Zhu & Zhang, 2006).

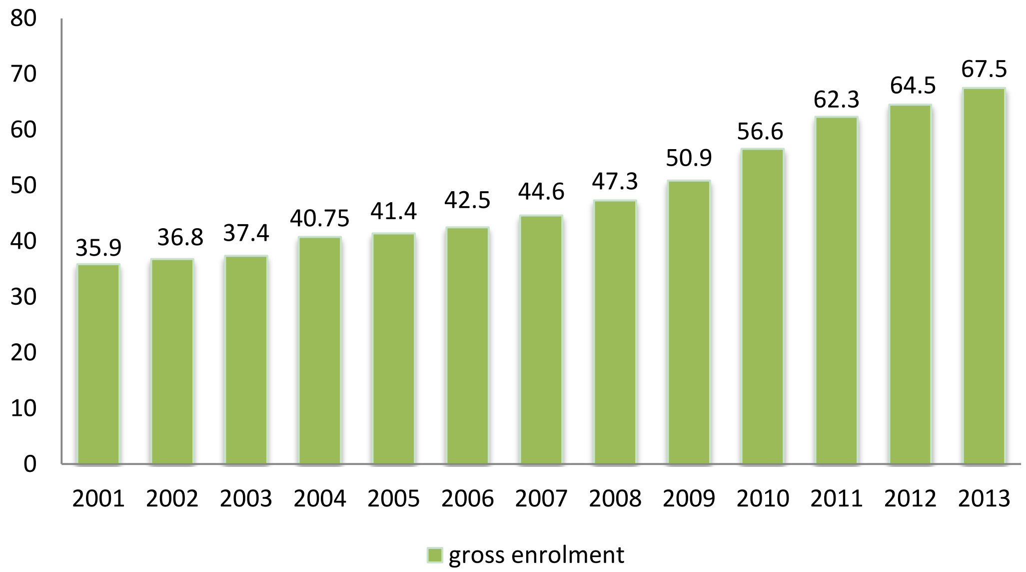

Figure 1.1. Percentage (%) of Preschool or Kindergarten Provision Participation for Children Aged 3 to 6 in China Between 2001 and 2013.

Source: Early Childhood Education Three-Year Action Plan Online Exhibition, Ministry of Education, China. http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/s7213/201305/151874.html.

Internationally, with more and more children attending non-parental childcare and education services before primary school entry (OECD, 2014), the impact of centre-based care and education experience upon children has been widely studied, largely in developed and Western countries. Many researchers, especially from the US, were concerned that early years (under age 3) non-parental or centre-based childcare experience for children could harm the child-parent attachment bonding and thus lead to behaviour problems during early childhood and even later at school (e.g. Belsky, 1986, 1988, 2001; Côté, Borge, Geoffroy, Rutter, & Tremblay, 2008; Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007; NICHD ECCRN, 1998b, 2003a; Vaughn, Gove, & Egeland, 1980).

Other researchers have argued that the quality of the childcare environment is a vital factor and higher quality childcare experience is beneficial for child wellbeing, especially for those children from disadvantaged backgrounds (e.g. Fox & Fein, 1990; Howes, 1990; Melhuish, 1987; Petrogiannis, 1995; Phillips, Mekos, Scarr, McCartney, & Abbott-Shim, 2001; Love et al., 2003; Vandell & Wolfe, 2000). Cultural context is also an issue of concern as many non-US studies have reported different results (e.g. Barnes, Leach, Malmberg, Stein, Sylva, & the FCCC Team, 2010; Borge & Melhuish, 1995; Datta Gupta & Simonsen, 2010; Zachrisson, Dearing, Lekhal, & Toppelberg, 2013; Petrogiannis, 1995; Stein, Malmberg, Leach, Barnes, Sylva, & the FCCC Team, 2013).

In contrast, research evidence on the effects of preschool programmes (3+ years) appears to be fairly consistent and positive with substantial research evidence that centre-based preschool experience is likely to be beneficial for school readiness, academic achievement, and school success (Barnett, 2011; Gormley, Phillips, & Gayer, 2008; Sylva et al., 2004). Again, the quality of programme matters and children from disadvantaged backgrounds benefitted more (Karoly, Kilburn, Cannon, 2005; Reynold, Arteaga, et al., 2011), but the general population could also benefit from the programmes (Melhuish & Malin, et al., 2008; Gormley, Gayer, Phillips, & Dawson, 2005; Gormley, Phillips & Gayer, 2008). With regard to the ‘notion’ of quality, although there have been various views on defining the ‘quality’ of childcare and education from researchers and educators, two main dimensions have been gradually identified to describe the quality in terms of structural aspects including setting and classroom features and in terms of process such as how the caregiver interacts with the children (Burchinal, 2010; Burchinal, Kainz & Cay , 2011; Lamb, 1998; Vandell, 2004; NICHD Early Child Care Research Network, 2002; Zaslow, Tout & Martinez-Beck, 2010).

Theoretically, most of the studies are more or less influenced by conceptual ideas from ecological system theory concerning how child wellbeing is affected by the social contexts, both proximal and distal, in which children are embedded (Bronfenbrenner, 1979, 1986; Bronfenbrenner & Morris, 1998, 2007). Therefore, the influences of centre-based childcare and education experience upon children wellbeing are usually discussed under the context that the child, family backgrounds as well as the home learning environment, have been taken into account.

In China, however, there is relatively less empirical evidence on the influence of centre-based childcare and education programmes on children development. Although convincing evidence has been derived from studies worldwide, largely from Western countries, that high quality centre-based preschool programmes are beneficial for child wellbeing, the cultural context is an issue to be aware of while interpreting and generalizing the existing research evidence into another cultural context. Moreover, considering the recent public and government movement in China in boosting national level participation in preschool centre programmes, especially in less developed regions and rural areas, it is necessary to comprehend the picture of ECEC development in rural China and understand the influence of such experience on children's development. Consequently, such evidence might be helpful in developing relevant ECEC policies in China.

The Present Study

After reviewing the literature on the effects of early child care and education programmes upon child development and mainly because of the insufficient studies and evidence on this topic in China, research questions were formed: Do preschool centre experience and preschool home activities influence children's cognitive and social development at school entry in the rural area in China? And how much can they contribute to children's development?

More specifically, this thesis aimed to address the following hypotheses:

1) Children with earlier preschool attendance will have better cognitive and social outcomes at school entry than those starting later.
2) Children who have experienced higher quality of preschool education will do better in their cognitive and social development at school entry than those experiencing lower quality preschool
3) Children who have experienced more learning relevant preschool home activities will do better in development outcomes than children who experienced these home activities less often.
4) After controlling for selected background child, parent and family characteristics as well as home activities, the beneficial effect of preschool on children's cognitive and social development at school entry will still be evident.

Structure of Thesis

The structure of the thesis is as follows. The current Introduction chapter first briefly introduces the national and international background for this study, followed by a comprehensive literature review of the impact of preschool provision on children development, with emphasis given to preschool centre programmes for children aged 3 to 6 years.

Chapter 2 specifically introduces the development of early childhood education and care services in China from the perspectives of historical context, current trends in policies and practices, and the challenges that are facing kindergarten expansion programmes at the moment are also discussed.

Chapter 3, methods, reports the procedure of participant selection, the research phases, the measurements and the analytic strategies that are used in the study. An ethics statement of the study is also given at the end.

Chapter 4, results, reports the findings in three stages. The first section describes children's demographic characteristics, the home activities, preschool centre characteristics, and development outcomes at preschool and at school entry. The second, section reports the associations between predictor variables such as demographic factors, home activities and preschool centre factors and development outcomes from univariate analysis. The third section reports the multivariate analyses to predict cognitive and social outcomes at preschool and at school entry.

Chapter 5 discusses the results regarding the research question 'are preschool home activities and preschool centre experience relevant for children's development at school entry?; and how much do they contribute to developmental outcomes at school entry?' Finally, limitations of the current study, implications and future research ideas are discussed.

1.2 Literature Review of the Impact of Early Years Provision on Children Development

Many studies have explored the influences of non-parental childcare and education preschool programmes upon young children's development and their lasting effects when children get older. While non-parental childcare usually refers to programmes for children under age 3, the non-parental education programmes provide services for children aged above 3 and before their school entry. This section reviews the impact studies both on childcare programmes (0-3) and preschool programmes (3+), with emphasis given to evidence of any impact on children's cognitive and social-emotional and behaviour development. It reviews studies from the following perspectives: research context, research methodology, research findings and any related research in China. Critiques of the literature are made later and a brief introduction to the aims of the present study is given at the end.

1.2.1 Research Context

Generally, there are two distinct areas of research about the impact of early child care and education programme upon children. They are 'Intervention' programmes for children from disadvantaged families and the universal or regular programmes for general population (Peisner-Feinberg, 2004; Melhuish, 2004; Melhuish & Barnes, 2012).

'Intervention' programmes for disadvantaged groups

Some studies have focused on the effects of specific 'intervention' or 'designed' programmes for disadvantaged children, 'disadvantaged' generally referring to children who live 'in poverty' or in an 'at-risk family', children 'from minority groups', or children 'with learning disabilities'. For example, the Milwaukee Project

(*N*=40) was designed for children whose mothers were 'unemployed, poor and with low IQ scores' (Garber, 1988). The Perry Preschool Project (*N*=123) and the Abecedarian Project (*N*=111) were both focused on the benefits of 'high quality centre-based intervention programmes' for 'African-American children' (Schweinhart, Barnes, & Weikart, 1993; Ramey et al., 1976). In general, these early intervention programmes were small scale and usually targeted specific groups of children and the programme settings were described as 'high quality, very extensive and model demonstrated' (Barnett, 1995, 2011).

There have also been large scale intervention programmes which targeted disadvantaged children. Two well-known examples are the Head Start (HS) study and the Chicago Child Parent Centre (CPC) project. Head Start is a broad-based early intervention programme initiated in the 1960s in the US. Thousands of children aged 3 or 4 from poor families were assigned as the 'intervention group' to centre-based 'Head Start' programmes with some provision of home-visiting and compared on a series of child outcomes to those children who were eligible but did not access the Head Start programmes (Currie &Thomas, 1995).

The Chicago Child-Parent Centre Programme (CPC) was initiated in 1966 and is a centre-based early intervention that provided comprehensive educational and family-support services to economically disadvantaged children (low income, mostly African American). These services include half- day preschool education and school-age services, family support and health services. Children and families assigned to the 'intervention group' received CPC services from age 3 while the 'control group' typically did not receive any educational services until age 5 (Reynolds, 2000).

Universal or regular programmes for the general population

Unlike studies which focused on the effects of 'intervention programmes', other studies explored the effects of 'natural' or regular settings of child care and education programme upon general population. These studies selected samples from the childcare and education programmes within the community and theoretically these sample programmes are not different from other programmes in the communities from which they are drawn. Two typical studies are the National Institute of Child Health and Human Development (NICHD) Early Child Care Research Network (ECCRN) study in the US and the Effective Provision of Preschool Education (EPPE) programme in the UK (NICHD ECCRN, 1998a; Sylva et al., 2004). Details of these two studies will be introduced later in the research methodology section.

1.2.2 Research Methodology

Experiments or Randomized Control Trials (RCT)

Normally, when researchers study the effects of specific intervention programmes upon children, a rigorous and experimental design is preferred. In some intervention programmes such as the Perry Preschool Project, the Abecedarian Project, and the Milwaukee Project, the RCT design was used and children were randomly assigned to 'intervention' or 'control' group, thus background factors which might influence the results were theoretically balanced. Two recent large scale RCT studies in the US were the Head Start Impact Study and The Early Head Start Research and Evaluation Project.

The Head Start Impact study is the first RCT design study to assess the impacts of Head Start on children and families during the children's preschool, kindergarten, 1st grade years and now through the 3rd grade years. Nearly 5000 newly entering children (either age 3 or age 4) from poor families were randomly assigned to the ‘intervention group’ that had access to the Head Start programme services or the ‘control group’ that did not have access to the Head Start programme but could receive other early childhood education services selected by parents rather than only receive parental care (US Department of Health and Human Services, Administration for Children and Families, 2010).

The Early Head Start Research and Evaluation Project (1996-2010), is a randomized trial of Early Head Start, a Federal early intervention programme for infants and toddlers in poverty. Thousands of children (initially 3000) were randomly assigned to the ‘intervention group’ using Early Head Start programme which provide child care, parent child activities, parenting and adult education, and other social services or to the ‘control group’ (Vogel et al., 2010; Love, Chazan-Cohen, Raikes, & Brooks-Gunn, 2013).

The RCT design is the most powerful evaluation strategy for studies intended to explore the pure effects of ‘intervention programme’ upon children and it is more likely to generate the most convincing evidence due to the rigorous design that controls for possible extraneous factors that may affect the results (Barnett, 2011; Melhuish, 2004).

For more widespread interventions, however, the randomized assignment of control groups usually has been not possible and thus the quasi-experimental design has been used. In the quasi-experimental designs, group assignment is not randomized and background factors are controlled by statistical adjustment.

Non-experimental designs or Observational Studies

Two well-known observational studies with quasi-experimental design are the earlier provision of Head Start Programme and the Chicago Child Parent Centres project

(Currie & Thomas, 1995; Reynolds, 2000). Both are large scale intervention programmes and since randomized assignment was not possible background factors of participants cannot be balanced by group assignment. In order to control for background factors, in both studies, a 'control group' was made by matching the background factors as close as possible and then using statistical techniques to control for initial differences (Currie & Thomas, 1995; Reynolds, 2000).

However, for studies which aimed to explore the effects of programmes upon general population within 'natural' settings, it is impossible or hard to use the RCT design, thus observational studies have been used (Melhuish & Barnes, 2012). In such studies, exploring the possible linkages between childcare and education experiences and children's development are their main focus. In general, children's early childcare and education experience are categorised according to the quality, quantity, type and stability (mobility) of the programme, while children's development is usually in terms of cognitive development, social-emotional, behaviour development, language development as well as physical development (e.g. NICHD child care study and the EPPE study).

Consistent with Bronfenbrenner's (1979, 1986) ecological system theory that features of the individual, family, environment and interaction among them all influence a child's development , some studies examined how background child, parent and family characteristics (like child's gender, age, birth weight, parents education background, marital status, working status and family income) as well as the home learning environment were associated with children's development at different stages (Alexander, Entwisle, & Kabbani, 2001; Bradley, Corwyn, Burchinal, McAdoo, & Coll, 2001; Bradley, McKelvey, & Whiteside-Mansell, 2011; Melhuish et al., 2008; Reynolds, Ou, & Topitzes, 2004; Sektnan, McClelland, Acock, &

Morrison, 2010). Without taking child, parent and family characteristics into consideration, the simple ‘correlations’ between the childcare and education experiences and children’s development can only suggest some conclusions of child care or education ‘effects’.

Some observational studies, which could be regarded as quasi-experimental studies, were not limited to finding 'simple correlations' between early child care and education experience and children’s development. By accounting for background child, parent, family characteristics as well as the home learning environment, researchers explored the effects of early child care and education experience upon children’s development and if these effects are long lasting. A mixed research design and sophisticated statistical methods were applied in this kind of studies and two well-known non-experimental studies are the NICHD child care study in the US and the EPPE study in the UK.

The NICHD child care study started in 1991 and aimed to explore the different aspects of childcare and education experiences (quality, quantity and type) on development before age 5, with subsequent phases looking at influences on children’s later development. All children in the study were enrolled at birth and then were followed through kindergarten, primary school, and up to secondary school and above (NICHD ECCRN, 1998a, 1999, 2002b, 2003a, 2003b, 2003c, 2005a, 2005b, 2006; Vandell, Belsky, Burchinal, Steinberg, & the NICHD ECCRN, 2010). Multivariate analyses were used and in order to address the selection bias problems of non-experimental studies, they tried different statistical approaches to test whether child care type and quality related to child’s development (NICHD ECCRN & Duncan, 2003). Controlling for a vast number of child, parent, and family characteristics relating to children's development, they found some specific effects of child care experiences before age 5 on different stages of children' development.

The Effective Provision of Preschool Education (EPPE) Project is also a large sample longitudinal non-experimental study (Sylva et al., 2004). It was launched in 1997 in England and was the first major study in Europe which aimed to see the 'added' value of preschool provision on children's development (Sylva, Melhuish, Sammons, Siraji-Blatchford, & Taggart, 2010). It recruited just over 3,000 children (2,800 preschool children and 310 home children) and followed their progress through preschool, primary school, secondary school and now after secondary school. The study used an 'educational effectiveness design' and followed the 'natural development' of the children to investigate factors like child demographic characteristics, parent and family characteristics, and the home learning environment, as well as preschool characteristics that may influence child development and how they influence child development. It employed both quantitative and qualitative analyses in the study. Multilevel modelling was used to explore the variations in the effectiveness of preschool provisions on child outcomes and 'outlier' preschool centres for further study. Qualitative methods were used to explore the characteristics of 'high quality' preschool centres (Sylva et al., 2010). The study expanded to the Effective Preschool, Primary and Secondary Education (EPPSE) programme following the children through their secondary school years and up to 16 year olds (Sylva et al., 2012, 2014).

In general, the NICHD child care study and the EPPE study are both large sample, non-experimental longitudinal studies. Sylva (2010) commented that in the EPPE study, their attention was not limited to '*establishing the simple effects of early education but towards an understanding of the familial and educational processes* *that underlie change in the developmental trajectories of young children*' (Chapter 1, p3). Moreover, both studies distinguished the different aspects of programme in terms of quality, quantity, type and stability (mobility) and their interaction effects on child development rather than treated childcare and education experience as one simple explanatory; third, both of two studies used scientific research design and sophistic methodology. They took comprehensive selection factors into consideration to explore the effects of childcare and education programme upon children thus they were widely influential.

1.2.3 Research Findings

It is never easy to answer questions such as 'does early child care and education have impact or not' and 'how much can they contribute to children's development' in simple words. The review of research findings reveals mixed and complex results. This section reviews the literature from the following aspects: positive, neutral or negative effects; immediate or short term and long term effects; fadeout or persistence effects; and metal-analysis results.

Positive, neutral or negative effects

Positive effects

Most of studies reviewed in this section reported that early child care and education experience, were positively associated with children's development. Experimental studies focussing on specific child care and education programmes which were taken as intervention strategies to improve disadvantaged children's well-being, generally showed convincing and consistent pattern of results (Melhuish, 2004; Melhuish & Barnes, 2012).

The Perry Preschool study reported impressive positive benefits of children's outcomes in terms of: higher IQ scores (at the end of the programme); better school achievement; better teacher-reported classroom and personal behaviour; less youth misconduct and crime; and fewer years of special education (Schweinhart, Barnes, & Weikart, 1993; Schweinhart & Weikart, 1997; Schweinhart, et al., 2005).

The Abecedarian full-day 'care' programme also reported positive effects for the 'intervention group' in the following aspects: higher IQ scores (from 18 months to 54 months) better reading and math achievement at school; and lower rates of school detention and special education (Ramey & Campbell, 1991; Ramey et al., 2000).

The recent large scale Head Start Impact study examining the impact of centre-based Head Start programme for children aged 3 or 4 from poor families also reported positive effects on child outcomes before kindergarten entry. After attending one year of the Head Start programme, age 3 cohort children benefitted in all the four domains examined (cognitive development, social/emotional development, physical development and parenting practices); for 4 year cohort children, positive effects were found in language and literacy elements of the cognitive domain and access to dental services in the health domain (US Department of Health and Human Services, Administration for Children and Families, 2010).

The Early Head Start Evaluation project found that, after receiving centre based childcare services (including child care, parent child activities, parenting and adult education, and other social services), children aged 2 or 3 benefitted in some aspects of cognitive and social-emotional development (Love et al., 2005).

In general, all four studies mentioned above showed positive effects of the 'intervention programme' on children's outcomes. However, it is important to bear in mind that the ‘intervention programmes’ are either small scale ‘high quality, very intensive, model demonstrated’ or specially designed large scale programmes which employed ‘appropriate curriculum’ together with health services and home visiting or other services. Moreover, these programmes were typically focused on children from families ‘at risk’ or living in extremely economically disadvantaged situations, therefore they do not reflect the ‘natural’ or regular experiences of most children in universal/regular early child care and education programmes.

Non-experimental studies which focused on effects of universal or regular programmes upon the general population, however, also showed that children can benefit from the non-parental childcare and education experiences (Peinsner-Feinberg, 2004; Melhuish, 2004; Melhuish & Barnes, 2012).

An OECD report (2011) based on almost all OECD countries examined associations between 15 year old children’s PISA performance in 2009 and their pre-primary education attendance. The conclusion was that students who had attended some pre-primary school outperformed students who had not, by about a year of achievement. This finding was supported by a number of empirical studies which focused on the effects of childcare and education attendance both from developed countries and developing countries.

Loeb et al. (2004) examined associations between childcare experiences (between 12 to 42 months) and children’s outcomes for 451 families in three counties in the US. After controlling for background, child and parent factors (like age, ethnicity, mother’s education, mother’s work and welfare status, and income), it was reported that non-parental (centre) childcare participation was still positively associated with child outcomes in the cognitive domain.

Similar findings were also reported from several studies which used data from the Early Childhood Longitudinal study (ECLS-K) in the US. Magnuson and colleagues (2004) explored the effects of prekindergarten on children's school readiness and found that, even after accounting for child and family background factors, children attending prekindergarten had better pre-academic skills (literacy and maths) at age 5 and 6, with greater effects for disadvantaged children. Loeb and colleagues (2007) also used data from ECLS-K, and was concluding that centre-based care raised reading and maths scores.

Studies from the UK similarly reported positive effects of early childcare and education programme participation on child outcomes. The EPPE study found that preschool experience, compared to none, can enhance children's development. These effects were evident for intellectual and social development during the early years of primary school (Sylva et al., 2004), at the end of primary school (Melhuish & Romaniuk, et al., 2006), in secondary school (Sammons et al., 2011a, 2011b), and up to age 16 (Sylva et al., 2014)

Côté and colleagues (2013) recently used a British cohort (n = 13,000) to investigate the association between child care during infancy and later cognition while controlling for social selection and missing data. It was found that attending informal or centre-based child care (at 9 months) was positively associated with cognitive outcomes at age 3 years, but only for children of mothers with low education.

Positive effects are also reported in studies from Argentina (Berlinski & Galiani 2007; Berlinski, Galiani, & Gertler, 2009), Australia (Coley, Lombardi, Sims, & Votruba-Drzal, 2013; Harrison, Ungerer, Smith, Zubrick, & Wise, 2010), Bangladesh (Aboud, 2006; Aboud & Hossain, 2011), Cambodia (Rao & Pearson, 2007; Rao et al., 2012), Germany (Anders, Grosse, Rossbach, Ebert, & Weinert, 2013), India (Hazarika & Viren, 2013), Portugal (Abreu-Lima, Leal, Cadima, & Gamelas, 2013), and Uruguay (Berlinski, Galiani, & Manacorda , 2008), that non-parental childcare and education programme participation have some positive effects on child development especially in the cognitive domain and academic outcomes and even later in adulthood.

Since there has been some evidence to support the idea that early childcare and education experiences can benefit child wellbeing, some researchers have focused on which aspects of experience are critical for child development.

The quality of non-parental childcare and education experience is an important indicator on children's outcome and there is growing evidence that quality of infant childcare is linked to cognitive and language development for infants and toddlers (Burchinal, Roberts, Nabors, & Bryant, 1996; Burchinal et al., 2000; Love et al., 2003; McCartney, 1984; Melhuish, 2001; NICHD ECCRE, 2000; Peck & Bell, 2014; Ruzek, Burchinal, Farkas, & Duncan, 2014). Three US based large sample longitudinal studies: the *Cost, Quality, and Child Outcomes in Child Care Centres Study* (CQO; *n* = 826); the *NICHD Study of Early Child Care and Youth Development* (SECCYD, *n* = 1364) and the *National Early Childhood Research Project (NCEDL)* have shown significant albeit modest associations between higher child care quality and cognitive development (Burchinal et al., 2008; NICHD ECCRN, 2005b; Peisner-Feinberg et al., 2001).

Moreover, the recent findings of the NICHD study, which followed children till age 15, found that the quality of early child care experiences can have long-lasting (albeit small) effects on middle class and affluent children as well as those who are economically disadvantaged (Vandell et al., 2010). Interestingly, a significant quadratic relation between childcare quality and adolescent cognition was found at age 15, which indicated that child care quality was linked to academic outcomes for those adolescents whose care, on average was of moderate quality or better, with the magnitude of the quality effects being larger at higher levels of quality. Another study from the US also supported this relation and reported that escalating effect sizes linked to quality in the moderate to high quality range (Burchinal, Vandergrift, Pianta, & Mashburn, 2010).

The UK based longitudinal study-EPPE- also found that high quality preschool experience is related to better intellectual and social behaviour development for children at school entry as well as age 11 outcomes, though the effect of low quality experience was not different from no preschool experiences at age 11 (Sylva et al., 2012).

Beside the quality factor, quantity of programme (in terms of timing or starting age of programme, duration of programme and intensity or dosage of programme) is also associated with children's development.

The Abbott Prekindergarten Programme Longitudinal Effects Study (APPLS) in the US (Frede, Jung, Barnett, & Figueras, 2009) reported that the effect size (*SD*) of two year Pre-K attendance on child outcomes at kindergarten entry was larger (language .42 *SD*, print awareness .31 *SD*, math .34 *SD*) than effect sizes for one year of pre-K attendance (language .21 *SD*, print awareness .29 *SD*, math .20 *SD*). Moreover, at the end of 2nd grade the effects of the Abbott Pre-K participation continued to be significant and the two year pre-kindergarten participation effect size was again larger than the effect size for one year of participation on the following outcomes: receptive vocabulary .22 *SD* for one year of attendance and .40 *SD* for two years; mathematics .24 *SD* for one year and .44 *SD* for two years (Frede et al., 2009). Overall these findings suggested that the quantity of the Abbott Pre-kindergarten participation was associated with better school outcomes. However, it is unclear that the effects were due to the duration of programme participation or children's starting age of programme participation, as these factors almost inevitably co-vary.

Reynolds et al. (2011) reporting on the Chicago Child Parent Centre study pointed out that the length of preschool intervention was unrelated to nearly all measures of well-being at age 28 but most consistent and enduring effects were for preschool participation, which started at ages 3 or 4. This finding suggests that the starting age of universal/regular programmes in non-experimental studies also need to take the starting age of programme into consideration. Loeb et al. (2007) used data from the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) and identified effects using OLS, matching and instrumental variables estimates. They reported that the greatest academic benefit was found for children who started centre-based programme at ages 2 to 3 rather than at younger or older ages; negative behavioural effects were greater the younger the starting age.

This effect of programme duration was also partially supported by a meta-analysis study conducted in the US (Leak et al., 2012). They reported that programmes starting before age 3 had effect sizes that averaged about .10 *SD* higher (although not a statistically significant difference) than later-starting programmes. Furthermore, the programme effect sizes varied little by programme duration. Findings from the EPPE study in the UK also suggested that earlier preschool attendance under age 3 is related to significantly better intellectual development at school entry especially for language outcomes (Sylva et al., 2008). Overall, these findings suggested that early childcare and education experiences can have positive effects upon children; the quality of programme is an important indicator on child outcomes and; the quantity of programme exposure also matters.

Negative effects

While most positive effects were found on children's cognitive development and school achievement, negative effects of non-parental early childcare were found mainly on children's non-cognitive development.

Researchers in earlier years were concerned that non-parental day care with repeated separation from mothers might harm the formation of mother-infant attachment and therefore lead to further detrimental effects on child development (Belsky, 1986). A series of studies have been designed following this concern and generated rather controversial results (Belsky, 1986; Blehar, 1974; Burchinal & Brayant, 1986; Gamble & Zigler, 1986; Jacobson & Wille, 1986). A few studies (Belsky, 1988; Clarke-Stewart, 1989) found a small but significant risk of insecure attachment for children who attended extensive day care in their first year. However, other researchers (e.g. Lamb, Sternberg, & Prodromidis, 1992) have argued that the apparent influences of day care on insecure attachment are open to variety of interpretations. It has also been proposed that the absence of good childcare quality may be the influential factor on insecure attachment (Howes, 1990; Melhuish, 1987; Pierrehumbert, Ramstein, Karmaniola, & Halfon, 1996). Researchers found that the increased risk for insecure attachments was more likely from samples which experienced poor quality non-parental care. Another criticism was the reliance on the measurement of insecure attachment with the *'strange situation'* (Clarke-Stewart, 1989). In summary, it is inconclusive whether non-parental childcare produces negative effects on the emotional development of children early in life but the findings from these studies suggested that there was a phenomenon to be explained.

Findings from the NICHD child care study showed that no single feature of the day care experience - quantity, type or quality of care - predicted attachment security, but one of the study's investigators (Belsky, 2009) has proposed that there are risks in the early years of intensive day care having a negative effect on attachment at 15 months if the following are experienced: (a) averaging more than 10 hours per week in any type of care, irrespective of quality; (b) enrolment in more than a single child-care arrangement; and (c) exposure to low quality care.

Beyond infant attachment, negative effects have been found on behaviour development with children in preschool or later in secondary school while they experienced extensive non-parental early day care. Findings from the NICHD SECCYD study suggested that more hours in child care and more centre-type care are related to higher levels of behaviour problems in young children and these effects persisted when children were in secondary school at age 15 (NICHD ECCRN, 2002b, 2003a; Vandell et al., 2010).

Other studies from the US which used data from Early Childhood Longitudinal Study (ECLS) showed similar results. Magnuson et al. (2004) estimated the effects of pre-kindergarten on children's school readiness and found that pre-kindergarten increased behavioural problems and reduced self-control. In another study, Loeb et al. (2007) reported that, not only do the negative behavioural effects appear for those children with at least 15 hours of care per week, but additional care (as measured by at least 30 hours of centre care), more than doubled this negative effect, from an effect size of .10 to.25 *SD* for the full sample. However, it is noteworthy that in this study, for English-proficient Hispanic children, the socio-behavioural effects are neutral which suggests that the effect might depend on family income and ethnic background.

Coley et al. (2013) used data from the Early Childhood Longitudinal Study—Birth Cohort (ECLS–B) to delineate links between early education care experiences and children's kindergarten skills. Their results replicated prior findings that greater exposure to centre-based care is associated with greater problem behaviours as well as lower learning-related behaviours in kindergarten and beyond.

Recently, Lee et al. (2014) also using data from the Early Childhood Longitudinal Study-Birth Cohort (n=6,950) reported higher levels of conduct problems for children attending Head Start programmes compared to children in parental care which supported the idea that centre-based childcare is associated with more behaviour problems.

A cross sectional sibling comparison study in the US (Jaffee, Hulle, & Rodgers, 2011), however, challenged this idea. Using data from 9,185 children (5 years and older) who participated in the Children of the National Longitudinal Survey of Youth (CNLSY), two comparable groups were formed; those for whom non-maternal care was initiated in the first 3 years and those for whom it was not. In this study, both between-family (full sample: 9,185) and within-family (subsample: 3,120 families whose children were at least 5 years old in 2004 and 2,713 whose children were at least 11 years old in 2004) comparison statistics were conducted. They declared that the timing of entry to non-maternal care in the first 3 years had neither positive nor negative effects on children's outcomes. More importantly, they found that enrolment in non-maternal care before the age 3 was associated with a host of child, maternal, and family factors. Although between-family comparisons showed that early non-maternal care was associated with higher achievement and lower behaviour problem scores in childhood and adolescence, but that observed associations could be confounded by measured and unmeasured family characteristics that influenced child-care choices and children's outcomes. A family fixed factor analysis was then conducted and the within-family comparisons failed to detect differences between siblings who had different early non-maternal care experiences.

These findings were also partially supported by longitudinal studies in the UK which examined the associations between early childcare experience and children's emotional and behaviour development up to school entry (Barnes et al., 2010; Stein et al., 2013; Sylva et al., 2011). No evidence of adverse consequences of childcare in the first three years were found and only small effects of non-parental care were found at school entry. Most importantly, they found the strongest and most consistent influences on behaviour and emotional problems were derived from the home with the home variables together accounting for nearly the half of the variance in children's emotional and behaviour outcomes based on the maternal reports.

None or little effects

Most of the literature reviewed showed either positive or negative effects of childcare and education experiences, a few studies, however, concluded that there was little effect for either cognitive or social development during the preschool years as well as later development (Chin-Quee & Scarr, 1994; Clarke-Stewart & Gruber, 1984; Deater-Deckard, Pinkerton & Scarr, 1996; Goelman &Pence, 1987; Kontos & Fiene, 1987). A few longitudinal studies in Sweden reported no evidence for day care effects (Hwang, Broberg & Lamb, 1991; Larner, 1982). Studies in Quebec reported that children who had experienced preschool programs did not do better than those without preschool experience (Jacobs, Selig, & White, 1992).

While most of the negative effects of early childcare on social, emotional and behaviour development were reported from the US, a Danish study (Datta Gupta & Simonsen, 2010) reported that, compared to home care, preschool enrolment at age three did not lead to significant differences in children's non-cognitive outcomes at age seven even taking child gender and maternal education into consideration.

Recent Studies from Norway, also reported little effect of childcare on children's externalising problems (Solheim, Wichstrøm, Belsky, & Berg-Nielsen, 2013; Zachrisson et al., 2013). As the authors in the Norwegian study argued, context is important to interpret the results and the presumed high quality of childcare and preschool settings in Norway was said to be an important explanatory factor for the different results with US based studies, although they did not actually have measures of quality. Therefore, it is important to take a programme's context into consideration and be cautious about making the conclusion that non-parental childcare is bad for children.

A study from Germany (Spieß, Büchel, & Wagner, 2003) exploring associations between kindergarten or preschool attendance and school placement at grade 7, also found no significant association between them. However, they acknowledged that kindergarten attendance was significantly associated with school placement for immigrant children in the sample, which suggest that effects of preschool or kindergarten might critically depend on background family characteristics with children.

In general, there are relatively few studies which reported litter or null effect of childcare and education programmes upon children comparing these studies which reported either positive or negative effect. One argument was that the 'file drawer effect', that insignificant results tend to be put in the drawer (Melhuish, 2004; Roggman, Langlois, Hubbs-Tait & Reiser-Danner,1994), and thus might lead to the smaller number of reviewed studies with null or little effects in this case. Indeed, that is rather a problem of all research.

Anderson and colleagues (2003) argued in a review article that a finding of insufficient evidence to determine effectiveness upon child wellbeing (e.g. behavioural and social outcomes, health screening outcomes, or family outcomes) should not be seen as evidence of 'ineffectiveness' but rather identifies a need for additional quality research.

Peisner-Feinberg (2004) suggested in a review article that the absence of effects in some studies might be accounted for in some cases by sampling issues (restricted ranges of child care quality and/or relatively small sizes) or in others by the outcomes measured (e.g. very low-frequency behaviours such as social withdrawal). Together with the findings drawn from studies mentioned earlier in this chapter (Barnes et al., 2010; Jaffee et al., 2011; Stein et al., 2013), overall this suggests that family characteristics and the home environment might be critically stronger predictors of children's social-emotional and behaviour development rather than the non-parental childcare and education experience with children.

Immediate or short-term effects and long-term effects

Some of the impact studies aimed to answer questions such as 'whether the intervention programme is effective for children's development and if it is effective, ‘whether this effect can last when they get older’? Whereas the lasting effects of programmes referred to ‘long-term effects’, the ‘immediate or short-term effects’ usually refer to the programme’s influence upon children within a year or two after children exit a ‘intervention programme’ or the ‘universal’/regular childcare and education programme.

A few well known longitudinal studies of intervention programmes reported both short-term effects and impressive long-term effects into adulthood. The experimental Perry Preschool Project has identified both the short- and long-term effects of a high quality preschool education programme for young children living in poverty (Schweinhart et al., 2005). It has reported on follow-up to 40 years old demonstrating short-term and long lasting effects as following: higher IQ scores at the end of programme (although disappeared by age 8), better school achievement (math and reading), less teacher reported classroom and personal behaviour problems, lower rates of youth misconduct and violence, lower rates of school dropout, higher rates of school completion, enhanced employment, reduced welfare-dependence and reduced crime and incarceration (Schweinhart & Weikart, 1997; Schweinhart et al., 2005).

Another well-known experimental study-the Abecedarian Project-has also reported short-term as well as long-term benefits of the intervention for participants through to age 30 (Campbell et al., 2014; Campbell et al., 2012; Muennig et al., 2011; Ramey & Campbell, 1991; Ramey et al., 2000). It was found that the treated groups benefitted from the ‘high quality intervention programme’ in the following aspects: better school achievement, reducing drug use and teenage pregnancy, lower rates of school detention, better educational attainment, higher education level, enhancing employment, reducing welfare-dependence and better adulthood health outcomes (Campbell et al., 2014; Campbell et al., 2012; Ramey et al., 2000).

The large scale intervention programme-The Chicago Child parent Centre project-also reported long lasting effects upon children to age 28 (Reynolds, Temple, Robertson, & Man, 2002; Reynolds, Temple, & Ou, 2003; Reynolds & Temple, 2008; Reynolds & Areteaga, et al., 2011). Reynolds and colleagues examined the CPC project effects on participants and reported impressing long term effects in terms of : higher rates of high school completion, lower rates of juvenile arrest, violent arrest and school dropout; higher rates of attendance in 4-year colleges, more years of complete education, lower rates of convictions, depressive symptoms, and out-of-home placement, higher educational attainment, income, SES and health insurance coverage, as well as lower rates of justice-system involvement and substance abuse (Reynolds et al, 2007; Reynolds & Areteaga, et al., 2011; Reynolds & Robertson, et al., 2011).

The Abbott Preschool Program Longitudinal Effects Study (Frede et al., 2007, 2009; Barnett et al., 2013) examined the long lasting effects of the Abbott Preschool programme up to fifth grade (age 11). This follow-up analysis showed that for the 4th and 5th grade outcome in terms of language abilities, math and science, children attending the Abbott Preschool programme all gained higher points. It was also reported that Abbott preschool attendance significantly reduced the likelihood of in-grade retention (by 40%) and the necessity of special education (by 31%) at grade 5 (Barnett et al., 2013). A few things to bear in mind to interpret these findings: first, the Abbott Preschool programme was designed to prepare children to enter school with the relevant skills and therefore it was of a ‘high quality standard’; second, although this study was employed in the low income area in New Jersey, it was open to children from all backgrounds.

Two more recent large scale intervention programmes in the US, the Head Start and the Early Head Start, have longitudinal results but have not identified such impressive long term effects (Barnett, 2011). The Head Start Impact Study (HSIS) employed a rigorous RCT design to evaluate the impact of one year in the Head Start programme. It was found that access to Head Start had positive impacts on several aspects of children's school readiness during their time in the programme. However, at the end of first grade, only a few statistically differences in outcomes between the treated and control groups remained, only a favourable impact for the 4-year-old cohort (ECLS-K Reading) and an unfavourable impact for the 3-year-old cohort (grade promotion) (Puma et al., 2012; U.S. Department of Health and Human Services, Administration for Children and Families, 2005, 2010).

The Early Head Start Evaluation study (EHS) showed similar results (Barnett, 2011). At ages 2 and 3 some cognitive and social-emotional benefits were found but by age 5 no effects were evident for cognition, and only one positive socio-emotional effect remained, a reduction in aggression. At grade 5 follow-up, no effects were found on any of 49 measures, including grade repetition and special education (Love et al., 2005; Vogel et al., 2010).

Long term effects have also been reported from non-experimental studies. The NICHD ECCRN study examined relations between non-relative child care (birth to 4 ½ years) and child functioning through to age 15 (Belsky et al., 2007; NICHD ECCRN, 2003b, 2003c, 2005a, 2005b, 2006; Vandell et al., 2010). Both quality and quantity of child care were linked to adolescent functioning (Belsky et al., 2007; Vandell et al., 2010). Higher quality care predicted higher cognitive-academic achievement at age 15, with escalating positive effects at higher levels of quality, and the association between quality and achievement was partially mediated by earlier child care effects on achievement. Higher quality early child care also predicted youth reports of less externalizing behaviour. Furthermore, more hours of non-relative care predicted greater risk taking and impulsivity at age 15, and this association was partially mediated by earlier child care effects on externalizing behaviours (Vandell et al., 2010).

Another well- known large scale longitudinal study-the EPPE- in the UK, also reported long term effects of preschool experiences (Melhuish & Malin, et al., 2008; Sylva et al., 2012, 2014). It has followed participants up to age 16 and impressive benefits of preschool experiences were reported (Sammons et al., 2002, 2003, 2011a, 2011b; Sylva et al., 2004, 2008, 2014). Take Key Stage 3 outcomes for example (age 14), it was found that, for social/behaviour outcomes till the end of key Stage 3 , preschool exposure was not significantly associated with child social-behaviour outcomes, but the quality of preschool (measured by the Early Childhood Environment Rating Scales) was still an important predictor in Year 9. For the academic outcomes, preschool attendance was still a statistically significant predictor in both math (ES=.26) and science (ES=.22) but not English. The quality of preschool also continued to predict better outcomes in maths and science at age 14. However, the effect sizes of medium and high quality in Math were slightly larger than for low quality (compared to 'home' group). In science, only those who had attended a medium or high quality preschool continued to show significantly better attainment than the home group at age 14. Overall, the findings suggest that higher quality preschool experience can have lasting positive benefits for all-round development, although by age 14 these effects are relatively modest for social behaviour (Sammons et al., 2011a, 2011b). The most recent report, on age 16 outcomes, revealed that there is an enduring effect of preschool experience in terms of attendance, quality and duration, whereas the early home learning environment, individual student, family and neighbourhood characteristics continue to influence student outcomes at age 16 (Sammons et al., 2014; Sylva et al., 2014).

Fadeout or persistence effects

Barnett (2011) reviewed four well known longitudinal RCT studies in US- *the Perry Preschool Project*, *the Abecedarian Project*, *the Head Start Impact Study* and *the Early Head Start Study*- noting that effect sizes all declined over time. As discussed earlier, the Head Start effect size starts small (*ES*=.18 on average for 13 cognitive measures) and disappeared shortly after school entry (US Department of Health and Human Services, Administration for Children and Families, 2010). A similar result was found in the Early Head Start study (Vogel et al., 2010).

The Perry Preschool Project and the Abecedarian Project, however, both started with larger effect sizes and have respectively smaller decline of effect size at later assessments (Barnett, 2011). Adult outcomes for both studies showed that the effect of early treatment on children extended well into adulthood (Campbell et al., 2012; Schweinhart et al., 2005). A possible explanation for the HS and EHS effects size decline was mentioned earlier: the control group in Head Start was not totally an 'at home' group but also partially participated into other programmes like Pre-Kindergarten. Another possible explanation is that high quality of programme delivery may be essential to ensure long lasting effect, but the programme quality cannot be maintained in the larger scale samples (Head Start and Early Head Start) in the way that it was in the small scale experimental programmes (e.g. the Perry Preschool Project and the Abecedarian Preschool Project) (Barnett, 2011). The Chicago Child Parent centre programme and the Abbott Preschool programme were both good examples that with high quality the programme can have long lasting benefits. In conclusion, the magnitude and persistence of intervention effects between intervention programmes differs greatly and some programme effects cannot be simply interpreted as fadeout.

Non-experimental studies like the NICHD child care study and the EPPE study (now extended to EPPSE) both showed persistent effects of early childcare and education experiences up to adolescence (Belsky et al., 2007; Melhuish, 2011). Moreover, the effect sizes varied for the quantity, quality and type of experiences. As discussed earlier, the high quality of experiences of child care or preschool seems to be an important indicator on children's outcomes and can have long lasting benefits.

Meta-analyses results

Meta-analyses can provide an overview picture of impact studies on early childcare and education programmes. The Consortium of Longitudinal Studies (Lazar & Darlington, 1982) was designed to investigate the long-term effects of early childhood education experience on children from low-income families in the US. In 1976, a multi-sample secondary analysis was conducted based on 11 programmes which had been independently designed and implemented by 12 investigators in the 1960s. It was found that early education programmes for children from low-income families had long-lasting effects on children's outcomes in terms of school competence, developed abilities, child attitudes and values, and impact on the family.

Gilliam and Zigler (2001) conducted a meta-analysis of all evaluations of state-funded preschool in the US from 1977 to 1998. Although several methodological flaws in these studies were identified, they found that the pattern of overall findings offered modest support for positive impacts in improving children's developmental competence in a variety of domains, improving later school attendance and performance, and reducing subsequent grade retention. Although significant impacts were mostly limited to kindergarten and first grade, some impacts were sustained several years beyond preschool. Again, it was found that only modest outcome goals are warranted for preschool programs serving low-income children (i.e. the promotion of school readiness).

Gorey (2001) conducted a meta-analysis of 35 selected quasi-experimental or experimental studies of preschool programmes in the US (1990-2000) to examine the short-and long-term effects of preschool intervention. More than 18,000 children in 200+ preschools were included and 80 study outcomes of cognitive, school performance and related person and social success were reviewed. It was found that preschool intervention has significantly positive effects on cognitive outcomes; intensive intervention programmes had larger effects on cognitive outcomes and these effects even persisted after 5 to 10 years; intervention programme also reduced the incidence of personal and social problems like school dropout, welfare dependence, unemployment and criminal behaviour.

These findings were supported by another meta-analysis study which also included 35 intervention programmes (Nelson, Westhues, & MacLeod, 2003). They found that preschool intervention programmes had effects on children’s cognitive and social-emotional functioning and these effects were even endured from kindergarten to grade 8. The effect sizes were in a small to moderate range.

In general, these four meta-analysis studies showed significantly positive and long lasting benefits of early childcare and education intervention programme. However, the numbers of studies included in analysis were relatively small and a broader look at the efficacy of early intervention programme was needed.

Camili et al. (2010) conducted a meta-analysis of 123 early childhood intervention programmes for children aged 3 to 5 which were drawn from a large meta-analytic US database - National Forum on Early Childhood Policy and Programmes. It examined the effects of early intervention programmes on cognitive and social development and reported significant effect sizes in the cognitive domain for children who had attended a preschool programme prior to kindergarten entry; positive results were also found for children's social skills and school progress, though they were relatively small. Moreover, it was found that the intervention time effects declined overtime. This study which covered 120 studies of cognitive outcomes carried out over 5 decades, provided greater weight for the argument that preschool intervention programmes provide a real and enduring benefit to children.

Another meta-analysis (Leak et al., 2010) was conducted on 117 studies which were drawn from the same data bases as Camili and colleagues (2010). It provided further information on the effects of programme quantity in which other studies did not addressed earlier. Using meta-analytic techniques and cross-study variability in assessment ages, the study estimated the separate effects of three time-related components - starting age, programme duration and the persistence of programme - as well as key interactions among them. It was found that on average, the programme effect size was .27 SD; the average effect size of programmes starting before age 3 was .10 SD higher than later-starting programmes (though it was not statistically significant) and there was little effect size difference for programme duration.

A recently reported meta-analysis study also deserves consideration because it was based on large sample longitudinal studies from the US and was not limited to experimental studies. Keys et al. (2014) reviewed four representative longitudinal studies in US: *NICHD Study of Early Child care and Youth Development (SECCYD), Early Childhood Longitudinal Study – Birth Cohort (ECLS-B), National Centre for Early Development and Learning (NCEDL)* and *Early Head Start (EHS).* The study examined associations between the child-care centre quality experienced by preschool aged children (3–5 years old) and school readiness skills at kindergarten entry. Furthermore, they explored whether those associations are moderated by either demographic characteristics or the child's entry skills and behaviours. The study found statistically significant, although small, preschool centre quality main effects for mathematics (B=.03, p< .05) and language (B=.05, p<.001). For social skills at school entry, this meta-analyses did not report significant positive quality effects, but did reveal significant interactions for one of six interactions between quality and demographic (quality x mother's education level) and one of three interactions between quality and child entry skills (quality x cognition). For problem behaviour outcomes, no evidence suggested preschool quality was related to externalizing problem behaviours even after accounting for demographic characteristics and entry skills with children. Results from this analysis suggest that the observed quality of the preschool centre classroom is very modestly related to: acquisition of language and mathematics skills overall, language skills for children of highly educated mothers (Bachelor's degree plus), and social skills for children who entered preschool-age care with lower cognitive skills or had mothers with some college.

All the meta-analysis studies mentioned till now are from the US and therefore results are based on the universal early child care and education programmes in a relatively similar context. A non-US meta-analysis with early childhood interventions was conducted by Nores and Barnett (2010) which has provided additional insight into the effects of early childcare and education programmes. In this study, 38 contrasts of 30 interventions in 23 countries were analysed. After calculating effect sizes (Cohen's D) for four outcomes: cognitive gains, behavioural change, health gains, and amount of schooling, they reported that children from different context and countries receive substantial cognitive, behavioural, health and schooling benefits from early childhood interventions and the benefits are sustained over time. Interventions that had an educational or stimulation component evidenced the largest cognitive effects.

Summary of findings

In conclusion, findings drawn from the literature reviewed suggest possible linkages between child care and preschool experience and child wellbeing.

First, for childcare programmes for children under age 3, the quality of the programmes matters: high quality of non-parental childcare benefits children's cognitive development in both short-term and long-term ways; low quality childcare can be a dual risk for children from low income families. Findings from the US or other countries which have a similar cultural context showed that extensive centre-based childcare can have negative effects on children's social-emotional and behaviour outcomes. Some studies from other cultures, however, showed either little/no negative or positive effects on children's social-emotional and behaviour outcomes, which suggests that effects of early childcare on children's social development are more mixed and therefore further studies from other contexts are needed.

Second, for universal or regular preschool programmes offered to the general population, the findings are relatively consistent: programme exposure is positively associated with children's development and school achievement; the quality of programmes is critical for long-term beneficial effects; the starting age of preschool programmes also matters for children's outcomes at school entry rather than only taking the whole amount of time spent in centres as indicator on children's outcomes.

1.2.4 Related Research in China

In China, researchers are interested in how background child and family factors are associated with children's school readiness and later school achievement. Some studies found that low income or low SES are associated with children's pre-academic (math and language) skills at school entry (Chen, Feng, Xiao, & Cang, 2009; Gai & Liu, 2008; Li, Zhang, Gai, & Jia, 2013; Xiao, Feng, Cheng, & Cang, 2009). Some researchers are also interested in how family/home environment (access to learning resources) can influence children's development at school entry (Sun, 2007; Sun & Lv, 2007; Zhang & Feng, 2012; Zhou et al., 2011). Whereas there has been extensive research on the 'effects' of early child care and education in the US and other countries, in China, only a few studies tried to answer the 'effect' questions.

One of them is a comparative study which aimed to make comparisons with preschool education and children's development between India and China (Zhou & Liu, 2008). They found that children in poor areas in rural China with three year preschool experience scored higher on standard cognitive tests than children with one year preschool experiences and higher than those with no preschool experience (Liu, 2008; Zhang, 2008; Zhang &Zhou, 2008; Zhou & Liu, 2008). However, it is unclear whether this difference in children's cognitive development was due to the influences of quantity of preschool experiences or the other aspects of preschool experiences (like quality), or the background child and family factors.

Rao and colleagues (2012) reported two studies which examined the relationship between preschool experiences and the early academic achievement of children in the same area in rural China. Findings from both studies showed that children with developmentally appropriate preschool experiences (kindergarten or separate pre-primary classes) had higher school readiness scores than other children.

Luo and colleagues (2012) also explored the associations between preschool experience and children's cognitive development at school entry in a poor area in rural China. This study used multiple regression analysis to test whether children with preschool attendance achieved higher educational readiness scores than those without preschool attendance. After controlling for the observed child and family factors, they found that preschool attendance was still significantly associated with children's educational readiness. This study used more complex analysis strategies, based on the basic cognitive developmental model that cognitive development is influenced by child, parents' characteristics and family characteristics as well as school environment. However, they took the programme participation as the predictor rather than the different aspects of children's preschool experience; moreover, only a handful of background child and family factors were taking into consideration and thus limited the interpretation of their findings.

Zhang and colleagues (2010) examined the school readiness achievement of children in a poor area in China and explored the possible influencing factors. They analysed data from 218 children and families from a poor rural area in North-West China and, using one-way ANOVA analysis, they found that family income (high: above 10,000

Yuan; Middle: 5,000-10,000 Yuan; Low: below 5,000 Yuan) was significantly associated with children's school readiness scores: the higher family income, the more likely better school readiness. Parents' educational level (High: high school and above; Middle: secondary school; Low: primary school and below) was also tested in one-way ANOVA analysis on school readiness, and it was found that father's education was not significantly associated with school readiness outcomes, but when mother's education level were primary school or below, their children's school readiness, apart from the motor skills, were more likely to be lower than those children whose parents were secondary school education background and above. The preschool/kindergarten exposure (exposure group: 65 children VS non-exposure group: 153 children) were also tested in one way ANOVA and it was found that preschool/kindergarten exposure did not show significant associations with children's school readiness. Again in this study, nothing is known about the inside of the preschool 'boxes', the nature of their experiences.

Another recent study (Zhang, Xin, & Chen, 2011; Zhang &Xin, 2012) examined the relationship between kindergarten enrolment age and four-year old children's cognitive and behaviour development. The sample comprised of 1,391 preschool children (mean age =4.6 years) from 74 kindergartens in six different provinces in China. This study is especially noteworthy because it revealed the curvilinear effects of kindergarten enrolment age on children's cognitive and behaviour performances. Using multilevel modelling, it was reported that: entering preschool or kindergartens between 2 and 2.5 years old resulted in the greatest effect on cognitive status (effect size = .26) compared with enrolment after 3.5 years old. Enrolment before age 2, however, did not result in better performance than the reference group. On the behaviour problem side, children with preschool/kindergarten enrolment age between

3- and 3.5 -years old had fewer problem behaviours than their peers whose enrolment age was later; children enrolled as young as two-year-old had no advantage over the "latecomers". In this study, it was also found that the level of kindergarten (province-level, city-level and community-level) significantly influenced cognitive outcomes: the province-level kindergarten was strongly associated with better cognitive outcomes. Since the 'level' of kindergartens is only a label of centres, further questions need to be answered such as which aspects of experiences between different 'level' kindergartens can contribute to the difference on child outcomes?

Li and colleagues (2014) conducted research at six public kindergartens in Beijing City, examining the influence of preschool education exposure (in terms of age of entry and hours of attendance per week) on children's literacy, numeracy, and classroom behaviour problems. Using hierarchical multiple regression analyses they found that entering preschool at a younger age and staying there for a longer time benefitted children's academic development. However, longer attendance was also linked to the likelihood of slightly more behaviour problems. They concluded that earlier entry age and higher intensity of attendance in preschools specifically benefitted the numeracy skills of children from families with lower middle income or somewhat lower education levels in Beijing.

In summary, children's family background factors like low income, low SES and home environment were found to be strong influences on children's development in China. Studies relating preschool or kindergarten experiences to children's development and academic skills are emerging and most of them were conducted in very poor areas in China. Some studies aimed to explore if preschool or kindergarten attendance, compared to none, was associated with children's school readiness and development at school entry; or if longer preschool experiences or earlier preschool attendance was associated with school readiness and child development at school entry.

Little is known about the effects of different aspects of preschool experience on child outcomes and the interaction effects within/between preschool experience and other background child, family factors. Also, research designs and analytic strategies in literatures reviewed in China are relatively simple and thus more scientific research design and sophistic analytic strategies are needed in the future study.

Summary

After reviewing the literature covering the various aspects: research context, research methodology, research findings and related research in China, it is concluded that:

Intervention programmes, no matter large scale or small scale, usually used randomized control trials or quasi-experimental design and generated relatively consistent evidence. Due to this rigorous design, evidence is more convincing; however the specialized nature of the programmes and the population offered the programme limits the generalizability of the evidence to the broader general population. For the universal or regular programmes for the general population, non-experimental designs are the norm and the selection bias is an important issue to take into consideration because it limits the determination of causality in findings.

Not only do child care and preschool experiences play an important role in promoting child wellbeing, but also some other background factors are important. The factors are not functioning alone, but interact with each other.

Effects of programmes are changing over time. Some effects are not found in the preschool period, but are found later in primary school or secondary school. This kind of ‘sleeper effect’ highlights the importance of longitudinal studies, and the way to interpret the results which were found in non-longitudinal studies.

While most of studies reviewed in this chapter were conducted in developed countries, especially in the US and UK, the numbers of studies from developing countries is relatively small. Even evidence drawn from existing literature suggests that the beneficial effects of early childcare and education experiences vary between countries. The cultural context of programmes should always be bear in mind when interpreting results, especially when there is any endeavour to provide policy implications.

Chapter 2 Early Childhood Education and Care in China: the History, Current Trends and Challenges

China has been experiencing rapid economic and social changes in the decades since the 1980s. As the world's most populated country with a population of over 1.35 billion, China is still a developing country and faces a lot of challenges in improving people's wellbeing (World Bank, 2013). Early childhood education and care (ECEC), which is deemed a way of improving children's wellbeing, is one of those challenges. In China, ECEC services are provided in two kinds of centres, one is a childcare centre or nursery which is usually providing services for children aged under 3, whereas the other kind of centre is preschool centre or kindergarten which serves children aged 3 to 6 years (up to age 7 in some areas) before school entry. Unlike countries such as the UK, France and Scandinavian countries which provide universal preschool care services, preschool education (3 to 6 years) in China is not part of the universal education system with patchy provision and childcare (0-3 years) services are even less inadequate.

The purpose of this chapter is to offer a general introduction on the development of early childhood education and care services in China, with emphasis given to preschool education services. This chapter includes four sections: the first section briefly describes the ECEC development in China in a historical context from the early 1900s when the first kindergarten was built to the late 1970s after the Cultural Revolution. The second section covers the ECEC development in China from the 1980s up to the present day from the perspective of policy changing, the ECEC reform and the challenges that are facing kindergarten expansion programmes. The third section describes the urban and rural disparities in ECEC development in terms of public attention and investment, kindergarten facilities and resources and staff training and education and so on. Finally, the chapter ends with a brief summary.

2.1 Historical Context

It was documented in Chinese literature that the first formal public kindergarten in China was built in 1903 by the then Convey governor Duanfang in Hubei province (Du, 1998). The kindergarten employed a Japanese headmaster and teachers and the curriculum was much influenced by Japanese education. Later, in 1904, the first regulations regarding preschool education were introduced and, although the regulations were mainly based on Japanese kindergarten regulations from 1900, it was the first kindergarten curriculum in China's modern education system (Tang & Feng, 2003).

In the first few decades of the twentieth century, China was experiencing dramatic cultural and social changes. Under the influence of the 'new culture movement' (also called the May 4th culture movement), some Western education theories were introduced into China. John Dewey's, Friedrich Froebel's and Maria Montessori's ideas on early childhood education were introduced and recognized in China and that led to national level reflections on traditional Chinese education ideology and practice in preschool education. Many scholars in education in China such as Tao, Xingzhi (1891-1946), Zhang, Xuemen (1891-1973) and Chen Heqin (1892-1982), initiated the ECEC curriculum experimental movement (Tang & Feng, 2003). They reflected on the ECEC curriculum in China and proposed the idea that it should be based on both Chinese kindergarten practices and also learning from progressive Western educational ideas and they developed different curriculum such as 'Action curriculum' (by Zhang Xuemen), 'wholeness or Units pedagogy' (by Chen Heqin).

In general, these curriculum reforms in the 1920s and 1930s were mainly influenced by Dewey's ideas and emphasised child- centred philosophy and practice (Wang, 2004). Based on these curriculum experiments, the Ministry of Education (1932) issued *'Kindergarten curriculum standards'* which was revised in 1936. This was the first formal curriculum standard in ECEC and it represented the end of a chaotic period for of the ECEC curriculum in China; its influence lasted up to the late 1940s for ECEC in China (Wang, 2004).

Since the founding of the People's Republic of China (PRC) in 1949, early childhood education and care in China experienced dramatic reform due to the change of political system to a socialist state. In order to meet the needs of a communist society, ECEC educators in China abandoned the child-centred philosophy and practices in ECEC curriculum and adapted teacher-centred theories and practices (Tang & Feng, 2003; Wang, 2004). Under the supervision of ECEC experts from the Soviet Union, the Chinese Ministry of Education (1951) issued *'Kindergarten Provisional Guidelines' (Trials)* which specified that physical education, language, science, drawing, handwork, music and arithmetic were the main subjects in the kindergarten. This document emphasised a teacher-centred pedagogy and advised that teachers should instruct children in purposeful and planned activities, and these guidelines played an important role in shaping early childhood education reform in China in the 1950s.

Early childhood education provision in China experienced tremendous growth between the 1950s and the 1960s. However, this growth did not last long; only until the Chinese Cultural Revolution (1966-1976). All schools were then closed and early childhood education also came under serious attack as during a ten year period only one teacher training school was left open (Tang & Feng, 2003).

2.2 From the 1980s onwards

2.2.1 Contemporary Policy Context

The 1980s was deemed as the coming back of 'spring' for China's economy as the 'reform and opening up policy' brought in a new era of economic development. The provision of early childhood education, which had been under serious attack during the 10-year Cultural Revolution was also recovering and back on track.

In 1989, the State Education Commission (now Ministry of Education), with the approval of China's State Council, issued the '*Kindergarten Work Regulations (Trial)'* and '*Kindergarten Management Legislation'*, which laid the basis for legislation for preschool education in China (Li, 2006). These two documents clarified the role of preschool education as the bedrock of the education system with the aims of caring and educating children to prepare them for primary school. These two documents also placed responsibility for implementation at provincial, regional and local levels, and introduced a multi-sector administrative system which involved the departments of Education, Health and Family Planning together with the Women's Federation. They required the formation of a cooperative system with shared responsibilities by each concerned department (Zhu & Zhang, 2008). Although these documents laid basic principles for kindergartens, there were difficulties putting the ideas into practice and many kindergarten teachers struggled to follow these ideas and principles in their day to day work. Zhu concluded that there was a big gap between the rationale advocated by these documents and educational practice.

In order to resolve these issues, the Ministry of Education (2001) issued '*Guidelines for Kindergarten Education (Trial)'* to provide guidance for kindergarten practitioners in implementing those progressive ideas in their daily practices. The guidelines were the result of early childhood education reform after the 1980s and were much influenced by Western education ideas and theories. They emphasised that children's experiences and individual difference should be recognized and respected. Preschool education should be a collaborative activity that engaged teachers and parents as well as communities.

To further the progress of reform, China's State council published an instructive policy document entitled *'Opinions from the Development (Units) including the Ministry of Education on innovations and development of early childhood education',* which was a cooperative product involving various Departments and Units (The State Council, 2003). It acknowledged the regional and urban-rural disparities in early childhood education development in China, and stated that the current services could not meet the needs of the public. It set a national five year goal that by 2007 the enrolment rate for three year preschool education should reach 55%, and 80% for one year preschool education. The magnitude and scope of early childhood education development indicated in this document are well beyond the 2001 guidelines and expected that there would be big steps in enforcing policies and principles into practice at provincial, regional and local levels. However, as a UNESCO (2007) report stated, one issue was that the underlying regional disparities required the adjustments to differ depending on 'local conditions'; such as 90% of children in middle and big cities should receive three years preschool education whilst in less developed area the target was 35%. Nonetheless, the State Council document marked a big improvement in early childhood education and care development in China, as diverse central bodies and responsible departments at different levels came together on a plan for putting policies into practice.

Despite all those years of improvement in policy enforcement, the number of public ECEC service programmes had been reduced dramatically due to the ‘one child’ policy and the economic system reform (Zhou, 2011). Due to dramatic reforms to the economic system in China, many early childhood programmes which were previously supported by public working units were either closed down, or were changed into private service centres as the result of working units closing down (Tang & Feng, 2003; Zeng, 2006; Zhou, 2011). On the other hand, the number of private services has increased. It was reported that between 2001 and 2007, the percentage of private early childhood service provision increased from 40% to 60% (Zhou, 2011). The increase of private ECEC services, however, did not fully meet up the parents’ demanding for high quality and affordable ECEC services, as many private centres aimed at high profits and could not guarantee the quality of the services. There was tension between the decrease of public ECEC services with a corresponding increase in private ECEC services and an increasing demanding for high quality and affordable ECEC services from the public. It is not surprising that many parents even could not find a satisfactory kindergarten for their children when reaching the preschool age (Beijing News, 2008; Jia, 2008; Wang, 2009; Workers Daily, 2008).

This issue aroused many public complaints and was reported widely in social media and press. Many ECEC scholars, who were also members of high political committees in the annual National People’s Congress (NPC) meeting and National Committee of the Chinese People's Political Consultative Conference (CPPCC), suggested that the government should take the leading role in ECEC development in China and also should encourage the public and society forces engagement in developing ECEC services (Liu, 2008; Pang, 2009, 2010). Liu Yan, a member of

CPPCC (2008) also suggested in the meeting that at least one year of universal preschool education should be part of the compulsory education system in China.

As part of the national strategies on the construction of a harmonious society, the Chinese People's Political Consultative Conference (CPPCC) (2008) proposed an important national strategy that saw the development of education as a priority for building a country with strong human resources. It was decided to develop a national plan for medium and long-term education reform and development (2010-2020). In July 2010, after three years of discussions from experts, public and politicians, China announced the *'National Plan for Medium and Long-Term Education Reform and Development'* (The State Council, 2010). Concerning the development of ECEC, the plan set concrete goals that by 2020 one year of universal preschool education should be provided for all children, with most children having better access to two-years of universal preschool education; three years of early childhood education should be accessible for the children in developed areas, and childcare or nursery services (0-3) should also be paid attention to. The plan also clarified the government's responsibility for the leadership role while social participation should be encouraged, and called for the strengthening of early education service provision in rural areas.

Later, in order to better implement the national plan, the State Council (2010) issued Document #41, entitled *'Issues Regarding Current Development of Early Childhood Education'* and, for the first time in the history, provision of early childhood education in China was recognized as an important measure of peoples' wellbeing (Zhou, 2011). The document also acknowledged that ECEC services in China were still the weakest link in the education system and faced severe problems such as inadequate education resources and investment, shortage of staff and teachers, uncompleted teacher training, and rural urban disparities. The document laid out ten principles for solving these issues: 1) the ECEC development should be placed in more important position; 2) expanding ECEC resources in a variety of ways; 3) strengthening the building of teachers' capacity through various ways; 4) increasing investment in ECEC services ; 5) strengthening the management of kindergarten enrolment; 6) strengthening the kindergarten security issue monitoring and supervision; 7) regulating kindergarten fee management; 8) applying scientific care and education to improve children's healthy development; 9) improving the working mechanism and strengthening organizational leadership; and 10) overall planning and implementing a 3-year Action Plan in developing early childhood education (The State Council, 2010; Zhou, 2011).

Soon after the central government released the policy and suggested the 3-year action plan, provincial governments issued a 3-year action plan at the provincial level which took provincial reality into consideration. Each county in each province was also required to develop a 3-year plan based on the ECEC service at county level. The policy in developing ECEC services in China was quickly widespread and implemented at provincial, regional and local levels.

The year 2010 is thought to be a milestone in ECEC development in China as important documents and policies were released by the government (Zhou, 2011). Since then, early childcare and education in China has come under the spotlight and reached a new developmental stage. In August 2011, then Premiere Wen Jiabao hosted a State Congress meeting and declared that the government would increase investment in early childhood education and arranged 50 billion RMB for developing ECEC in less developed Middle and Western areas in China. Following his statement, the Ministry of Finance (2011) issued document [405] entitled *'Issues on increasing financial investment and supports in early childhood education development'* approved by the State Council, which highlighted the urgency of increasing investment from central government, provincial and local government in developing ECEC services to meet the public demand. It also clarified the leading role of government, encouraging social participation and placed the main funding responsibilities at local government level while the central government could contribute through rewarding progress and offering subsidies. The document placed the priority of central government financial support and investment to expand early childhood and education programmes to less developed Middle and Western area in China, and the central government could contribute to up to 80% of investment in expanding ECEC services in relevant areas. The staff training programme in Middle and Western area would also be included in the national teacher training programme and central government would arrange special funding to support the programme.

With the combined efforts of central government, provincial and local government at the policy level and the financial level in development of ECEC in China, it was reported that by the end of 2013, children in kindergarten reached 38,950,000, with an increase of 9,180,000 children from 2010, and the three year preschool education gross enrolment was 67.5%, with a 10.9% of increasing from 2010, which has already meeting the target set in the 2010-2015 plan (Ministry of Education, 2014).

An overview of the policy development in early childhood education and care in China from the beginning of the 1980s up to the present day reveals that the importance of ECEC has been gradually recognized by the government and the public. From the earliest view that preschool education is a preparatory stage for school education to the latest view that it provides the basis for optimal child development and wellbeing, early childhood education and care is receiving more and more attention and investment from the government and public.

2.2.2 Curriculum

Early childhood education curriculum reform is part of the ECEC reform process since the 1980s, and it is central to ECEC development and reform. In the 1980s, China was recovering from the Cultural Revolution (1966-1976) damage. Early childcare and education, which was also under attack during the cultural-revolution, was expecting further reforms.

In October 1981, the Ministry of Education issued '*Guidance for Kindergarten Education (Trial draft)'* and specified the curriculum or teaching content which includes activities in eight domains and described different development goals for children at different age groups. Importantly, this document recognized the role of play and advised teachers to integrate play, collective teaching activities, physical activities and other daily activities together in fulfilling the educational goal. Also, as the 'one child' policy was introduced in the 1980s, the document emphasised the needs for cooperation between kindergartens and families.

In the earlier stages of ECEC reform in the 1980s and 1990s in China, the reform was following the basic principles which were demonstrated in '*Kindergarten Work Regulations (Trial)'* and '*Kindergarten Management Legislation'.* Piaget's child development theory played an important role in developing the curriculum for children in that period. Other theories such as 'action theory' 'ecological system theory', 'emotional intelligence theory' as well as some theories on children's play also played an important role at that time (Wang, 2004). Under such circumstance, the spirit of curriculum reform was much clearer, indicating that the curriculum contents should be integrated and emphasised on interactions between children and environments. Children’s play and daily activities were seen as important for children development and thus should be valued in the kindergarten curriculum.

In the late 1990s, theories such as ‘zone of proximal development’, ‘social constructivism’, ‘multiple intelligence’, ‘Reggio Emilia approach’, ‘project approach’ were well recognized in China and became influential in developing the ECEC curriculum (Feng, 1997, 2003; Wang, 2004; Zhu, 2004). ECEC educators and practitioners began to embrace the ideas that: 1) children’s experiences are important and children could develop their cognitive abilities while interacting with environment; 2) social culture environment is important for children’s development and cooperative activities should be valued; 3) children’s engagement in activities, interactions with environments are important for their development and their own interests should be valued; and 4) children have multiple intelligences and creativity ability, imagination is important for children’s development and thus the ability should be valued and cultivated in the kindergarten curriculum.

However, it was not easy to employ these progressive ideas and principles in kindergarten practices. In order to fill the gap between ideas and practice, the Ministry of Education (2001) issued the document ‘*Guidelines for Kindergarten Education (Trials)’* which aimed to provide practical guidance for ECEC educators. It specified kindergarten educational contents from five main domains: health, science, language/literature, arts and social studies and explained the goals, education contents and practical advices for kindergarten practitioners. The guidance was soon in wide-spread use in the country and played a very important role in kindergarten curriculum reform at that time. Kindergartens and ECEC educators are encouraged to develop their own curriculum such as the integrated- themed curriculum model employed in Shanghai kindergartens (Shanghai Education Committee, 2002).

Nowadays in China, many Western curriculum models such as the Reggio Emilia approach, Montessori education and the Project approach are spreading widely and are adopted into Chinese culture. Liu and Feng (2005) concluded that such curriculum reform had promoted three main ideas: 1) respecting children, 2) active learning, and 3) play-based teaching and learning. However, these curriculum reforms have not been without criticism. One concern was the clash between advanced ideas, theories and kindergarten practices and reality (Corte et al., 2006; Hua, 2009; Zhu & Zhang, 2008).

Professor Hua, who is a key member in drafting the 2001 version 'Guidelines for Kindergarten Education (Trials)', explained in the book- Preschool in Three Cultures-Revisited- that the 2001 version of Guidelines borrowed ideas from abroad such as Project Approach, Reggio, Developmentally Appropriate Practice, Vygotsky's Zone of proximal Development, and Multiple Intelligences, without named them explicitly in the guidelines but were integrated under the concepts of 'respecting children' and 'children's life-long learning '. Hua also pointed out that '*the success of the reform depends on teachers' understanding of how and why to teach children in the ways the Guidelines suggest*' (Tobin, Hseueh & Karasawa, 2009, p83-84).

Kindergarten teachers in China, however, have been used to the teacher-centred teaching practices in classroom for a very long time, which meant that it was not easy for them to adapt to the child-centred curriculum in their day to day practices without substantial training and guidance. This argument is supported by a Chinese study which explored how Chinese kindergarten teachers organized group activities for children aged 3 to 6 in Shanghai (Qi, 2009). It was revealed that, 1) teacher-directed group activities were still dominating in Chinese kindergarten classrooms which were reflected through every phases of group activities, despite under the context that early childhood education in Shanghai had been experiencing curriculum reform for years; 2) kindergarten teachers in Shanghai were provided with low-structured textbooks on organizing group activities, which reflected the reform idea that encouraging child-initiated, theme-integrated activities rather than teacher-centred, subjects divided curriculum in kindergartens. However, it brought big challenges for kindergarten teachers in planning and organizing group activities, especially while integrating mathematic and music learning activities with vary subjects due to the different logistics and structure of mathematic and music related knowledge from other subjects. In other words, this Chinese study highlighted the practice reality in kindergartens and the challenges for kindergarten teachers under the movement of curriculum reform in Shanghai City.

Another concern was whether the newer methods were culturally appropriate (Hua, 2007; Zhu & Zhang, 2008). Traditional Chinese culture, communist values, and Western cultures are influencing the ECEC development in a rather complex way (Tobin, Hsueh., & Karasawa, 2009; Tobin, Wu., & Davidson, 1989). The ideology of collectivism in a Communist society and the individualism ideology that value independence and self-reliance are both influencing Chinese society nowadays; How to balance or incorporate these ideas into ECEC curriculum and how to provide the most appropriate ECEC curriculum for children is still an ongoing debating issue in China (Hua, 2007; Tobin, Hsueh., & Karasawa, 2009).

2.2.3 Staffing and Training

Regulations and policies

Staffing and staff training has been great challenges for ECEC development in China for a long time. It is well documented in many Chinese official ECEC regulations and documents that kindergarten head teachers, teachers, childcare workers, health workers as well as other staff working in kindergartens should meet certain basic educational and qualification requirements.

The kindergarten Management legislation (Ministry of Education, 1989) specified that kindergarten heads and teachers should have graduated from an early childhood teacher training school or vocational college (usually with a three year course completed for junior high school graduates), or they would have to take the examination supervised by local education administration authority.

The Ministry of Education (1996) later released document '*Kindergarten Work Regulations'* which specifies further educational and qualification requirements for staff working in kindergartens. For kindergarten heads and teachers, in addition to meeting the basic requirements of being graduates from a teacher training school or college, they should hold teachers' certification. The head teacher should also have education work experience and have completed the training credentials for Head teacher Position (Li, 2006).

In 2001, the release of '*Guidance for Kindergarten Education'* (Ministry of Education, 2001) was an important marker for early childhood education reform in China. Kindergarten head teachers and teachers were required to understand the spirit of the reform and transform the advanced ideas and theories into kindergarten practices. Sufficient professional training for teachers was one key element to successful reform (Liu & Feng, 2005), and some official documents such as '*Chinese Children's Development outline 2001-2010*' (The State Council, 2001), the

‘*Guidelines for the Reformation and Development of Young Children’s Education’* (The State Council, 2003) called for higher qualifications for teachers, highlighting the importance of teachers’ professional training.

In 2010, early childhood education and care in China entered a new era of development. It was specified in *the ‘National Plan for Medium and the Long-term Program for Education Reform and Development’* (The State Council, 2010) that early childhood education is critical for children’s wellbeing and declared that the government should put more efforts in developing ECEC services. In response to the national plan, the State Council (2011) released ‘*Issues Regarding Current Development of Early Childhood Education’* and highlighted the top ten issues concerning early childhood education in China, which included strengthening the teaching capacity. Soon after that, ‘*Kindergarten Teacher Professional Standards’* (Ministry of Education, 2012) were issued, clarifying the basic principles, professional standards and requirements for kindergarten teachers.

Examining these regulations and documents concerning early childhood education staffing and training in China in the last few decades, it is clear that the educational and qualification requirements for ECEC practitioners are increasing gradually. However, it has yet to be determined the extent to which these regulations and policies have influenced kindergarten practice or the reality of staffing in kindergartens in China.

Big numbers

The demanding for qualified ECEC practitioners is increasing in China and qualifications of kindergarten head teachers and teachers have undergone steady growth since the 1990s in terms of degree level education, certificate level education and professional training according to the official statistics reports (Ministry of Education, 2013). Taking the number of kindergarten teachers for example, in 1991 around 17,700 teachers were awarded their first degrees in education through 3- or 4-year college or university training whilst more than 90,000 teachers got their first degrees in education in 2000, and the number rose to 212,893 in 2012 (Ministry of Education, 1991, 2000, 2012).

Alongside the phenomenon that the number of teachers with associate degrees (level between high school and undergraduate degree) and undergraduate degrees is increasing over time, the percentages of kindergarten head teachers and teachers with higher academic qualifications is also rising.

In 2001 less than one third (32%) of kindergarten heads and teachers had graduated with an associate degree (30%) or undergraduate degree (2%), while the majority were high school graduates (60%) or even with lower academic backgrounds (8%)(Ministry of Education, 2001). Five years later in 2006 more than half of kindergarten heads and teachers had an associate degree (45%) or better (7%), while the remainder were high school graduates (44%) or with lower than high school qualifications (4%)(Ministry of Education, 2006). By 2012, the percentage of teachers with an associate degree or above reached two thirds (66%), while other teachers were either high school graduates (31%) or had lower qualifications (3%).

Furthermore, there were in total around 198,600 kindergartens nationwide in China in 2013, an increase of 48,200 from 2010. There were approximately 2,830,000 kindergarten staffs in 2013, an increase of 980,000 since 2010. The number of children in kindergartens reached 38,950,000 in 2013, an increase of 9,180,000 from 2010 (29,766,695) (Ministry of Education, 2012; 2013)

2.2.4 Group Sizes and Ratios

The required class size and staff child ratios are specified in relevant official documents (Ministry of Education, 2013) (see Table 2.1). However, it was reported by the media and press that larger class sizes in kindergartens still exist (Dongfang Daily, 2012; Zhang, 2014). It appeared that kindergartens in rural areas were more likely to have larger class sizes due to reasons such as a shortage of kindergartens or lack of teaching staff. However, many kindergartens in urban areas also have more children per classroom than the regulations specify due to the huge demand for preschool places from parents.

Table 2.1 Standards for Kindergarten Group Sizes and Staff: Child Ratio

Age group	Classsize (person)	Full day		Half day	
		Teaching staff	Care worker	Teaching staff	Care worker
（3～4）	20～25	2	1	2	1*
（4～5）	25～30	2	1	2	
（5～6）	30～35	2	1	2	
Mixed age group	< 30	2	1	2～3	

Note: *Kindergartens meet essential requirements should equip with one care worker.
Source: Kindergarten staff to child ratio standards (Trials) (Ministry of Education, 2013) http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/s7215/201301/147148.html

Typically, a kindergarten classroom has two teaching staff and one care worker. Most of the kindergartens provide a full day service meaning that teachers and care workers should usually work for whole day but in some teachers are sharing workloads so that one is present in the morning and the other in the afternoon. This means that the actual staff-child ratio in classroom may not be the same as registered staff: child ratio (Liu, 2014)

2.2.5 Quality Issues

The importance of early childhood education and care programme quality has been well recognized in studies from Western countries (Burchinal, Kainz, & Cai, 2011; Love et al., 2003; NICHD ECCRN, 2005b; Peck & Bell, 2014; Peisner-Feinberg et al., 2001; Sylva et al., 2004). One prime conclusion from these research studies is that ‘process quality’ is a key predictor of the effects of childcare and education programmes on children’s development (Hunstsman, 2008). Process quality is usually assessed by a composite measure of interactions and the environment (Burchinal, Kainz, & Cai, 2011; Cryer, Tietze, Burchinal, Leal, & Palacios, 1999). Furthermore, ‘structural quality’ indicators such as staff educational background, staff: child ratio, group size as well as other environmental resources and facilities in programme setting, are key determinants of ‘process quality’ (Burchinal, Howes, & Kontos, 2002; Phillips & Howes, 1987; Ruopp et al.,1979).

In China, the importance of quality in ECEC programmes has also been recognized, although the ‘variation in the quality of ECEC is still a debating issue. The Chinese National Institute of Education Science Early Childhood Education Research Centre published the ‘Preschool Education Quality Assessment Tools’ (2009) which consists of 10 assessment tools such as Overview of kindergarten interview; Kindergarten classroom assessment; Observation of half-day activities arrangement; Observation of children’s activities; Observation of teachers’ activities; Observation of child-teacher interaction; Child development assessment; Teachers interview (education ideas and behaviour); Family and home environment interview; and the

Early Childhood Education development interview (district-based). The composite tools have clearly shown the influence of Western education evaluation theories that the structure-, process- and performance- evaluation are all included in this composite. However, Guo and He (2009) have argued the appropriateness of including children's development as indicators of kindergarten quality, considering that child development outcome is a complex product of both 'nature and nurture'. There is also argument on whether 'parents satisfaction' should be considered as a key indicator of kindergarten quality (Yuan, 2011), since many kindergartens put 'parents satisfaction' as priority task while organizing kindergarten activities.

Wu (2011) reviewed the Chinese ECEC quality evaluation studies between 1970s and 2010s in an article and concluded that the Chinese ECEC quality evaluation was largely influenced by the Western education theories, especially from the US. This also reflects the ECEC modernization trends in China since 1980s that adopting the progressive ideas from Western cultures with a focus on more individualized education, more focus on the rights of the child and on promoting independence and creativity in children.

Quality assessment or monitoring systems in China

Currently China has no nationwide evaluation standard and monitoring system for early childhood education and care programme quality. There are provincial, city and local level evaluation or monitoring systems in many areas which also serve as a general reference for the practice of kindergarten education (Wang & Li, 2014). However, it was reported that these evaluating system were usually focusing more on 'hardware' environmental features or the 'structural quality' of programmes but placed less emphasis on the 'process indicators' of quality which are very important but harder to assess such as relationships and pedagogy (Corter et al., 2006; Qian, 2012; Wong & Pang, 2002;). It was also reported that these evaluation systems pay more attention to similarity than to difference, more on what is occurring in the present rather than on ways to improve quality (Qian, 2012).

These gaps were recognized in the advisory document #41 issued by the State Council (2010)-'*Issues Regarding Current Development of Early Childhood Education'*- which specified that one of the important issues concerning ECEC development was the need to apply scientific care and education in improving children's wellbeing, suggesting that an effective early childhood programme quality monitoring system should be established.

Challenges and efforts

It was widely reported in Chinese media that the gross enrolment of children in China in three year preschool programmes had reached 67.5% in 2013 with an increase of 10.9% since 2010 (Ministry of Education, 2014), while the gross enrolment in 2003/04 was only around 36% (UNESCO, 2007). However, there remains a big concern that the increase in gross enrolment does not guarantee that children are experiencing better or higher quality preschool programmes.

Scholars and experts are concerned that, in order to reach the goals which were set by the government in national plans (2010-2020) for education reform and development, the size of classrooms might be getting bigger, and staff with lower qualifications might be recruited into kindergartens due to kindergarten expansion programmes (Kang & Liu, 2014; Liu, 2014; Yu, 2014). In other words, the quality of preschool programmes might not be improved in the process of kindergarten expansion programmes in order to meet the gross enrolment (Kang & Liu, 2014; Liu, Z. L., 2010a, 2011; Hua, 2014).

The Chinese government also made some efforts to deal with the issue of ensuring the quality of preschool programmes including the publication of non-statutory document #4 *'Early learning and Development Guideline: Age 3 -6'* (Ministry of Education, 2012). The purpose of this guidance is to help early childhood education teachers, care workers as well as parents to understand children's learning and development. For kindergarten professionals especially, this guidance is aimed to help them to improve the quality of programmes.

The document describes children's learning and development in five different areas including Health, Science, Literacy/Language, Social studies, Arts and indicates developmental goals for children at different ages (3 to 4, 4 to 5 and 5 to 6 years) with respective guidance for practitioners. The guidance identified four principles of children's learning and development: 1) every child is unique and aspects of development and learning in each of the five areas should be integrated with each other; 2) respect children's individual differences in learning and development; 3) understanding that children's learning and development are based on direct experiences through play and daily activities; 4) children's approaches toward learning are important and positive learning attitudes and behaviours such as persistence, creativity and imagination are beneficial for lifelong learning and development.

The document has been disseminated nationwide and the ideals and principles were explained and introduced to kindergartens and practitioners by the scholars and experts who helped with designing the guidance document. The ideas and principles stated in the guidance have been widely praised by education authorities, experts and kindergarten professionals as a means of developing successful and effective early childhood education programmes for children in China (Li & Feng, 2013).

However, the consistency between principles and practices guidance, the gaps between advocated ideas and reality in kindergartens should not be ignored. For example, it is advised by scholars and experts that the guidance should not be treated as a standard for measuring children's learning and development and that practitioners should respect individual differences in development (Li & Feng, 2013). However, it is not yet clear how to guarantee the fidelity of implementation of the guidance and to ensure that it is not being used by practitioners or parents to judge children's progress (Morning Post, 2012).

In summary, there are currently no nationwide standards for monitoring or evaluating the quality of early childhood education and care programmes in China. Existing systems at the provincial or city level are used mainly for administrative purpose by education authorities and are focused on more easily measurable structural elements (e.g. teachers' qualification, amounts of books and toys, building conditions). In the process of kindergarten expansion to achieve the enrolment goals set by government in 2010, the quality issue has been raised by experts and scholars and the Chinese government is also making efforts to improve the quality of ECEC programmes by planning to build a nationwide quality monitoring system.

2.2.6 Public and Private ECEC Programmes

As explained earlier, due to the 'one child' policy and the economic system reform, the number of public ECEC programmes in China had been reduced dramatically (Zhou, 2011). In the meantime, the number of private ECEC programmes had increased phenomenally. For example, according to official education statistics, there were 44,526 kindergartens registered as private centres in 2001, which only stands for around 40% of total kindergartens (n=111,706) in China. However, the percentage of private centres had reached to 67% (n=133,451) amongst 198,553 kindergartens in China in 2013 (Ministry of Education, 2001; 2013).

Moreover, the percentage of private ECEC programmes in urban and town areas are bigger than in the rural areas in China, although they were both increased overtime. In 2005, around 62% of kindergartens in urban and town areas were private centres (private: 39,566; overall: 64,181), while in 2013 the percentage of private centres had reached to 72% (private: 93,140; overall: 128670). Meanwhile in rural areas, the number of private centres was increased from 29,269 (49%) in 2005 to 40,311(58%) in 2013 (Ministry of Education, 2005; 2013).

There are few evidence-based reports in China on ‘whether public kindergartens can provide better service for children and families than private kindergartens’, although there are public concerns that private centres are usually ‘profits-driven’ that some preschool centres cannot guarantee the quality of programmes, or their services are too expensive for general population (e.g. centres with sky-high prices) (Liu., Li., Pan., & Zhang, 2008; Zhao, 2008; Zhou & Ye, 2011).

Nonetheless, the private ECEC programmes are still playing a very important role in providing ECEC services due to the lack of public services and the Chinese government are also encouraging private investments into ECEC services (The State Council, 2010). However, new regulations are needed in managing and evaluating the private sections of ECEC programmes in China (Pang, 2014).

2.3 Big Gaps: The Urban and Rural Disparities

China has made great efforts in improving early childhood education and care services in the last few decades and the public and political profile of ECEC nowadays in China is much stronger than ever. However, regional and socioeconomic disparities in terms of access to and quality of ECEC services are widely acknowledged by the government in various official documents (Ministry of Education, 2014; The State Council, 2010).

The regional disparities in early childhood education and care are usually linked with gaps between economically developed regions (such as Eastern, coastal areas) and less developed regions (such as Western, middle inland areas) in China, which have experienced different economic development paces due to reasons such as national development plan policies (Chen & Zheng, 2008). Furthermore, urban and rural areas disparities in ECEC also exist alongside the Western and Eastern regions disparities. Rural areas in China are usually economically less developed. In this section, the introduction of regional disparities in China will give emphasis on the development gaps between urban and rural areas in terms of the public attention and investment, programme availability, as well as staff training and qualifications issues.

2.3.1 Public Attention and Spending

It has been widely acknowledged by the Chinese government on many occasions that ECEC development in rural area is far behind than in urban areas and it has been a challenge to achieving national plans for ECEC development and reform. Although the central, provincial and local level policies all include plans to reduce regional disparities in ECEC nationwide, the lower targets for ECEC access, for staff quality, or for formal centred based programmes may mean that these policies are not achieved (Corter et al., 2006; Liu, Z. L., 2010b).

In 2003, the China State Council published a policy document entitled *'Opinions from the Department (Units) including the Ministry of Education on innovations and development of early childhood education'*. It was stated that for cities and developed areas the preschool target was 90% of children to receive three years of preschool education, while the target was only 35% for less developed areas. Similarly, in 2010, the China State Council issued document #41 *'National plans for medium term and long term education development and reform'* which specified the development goal for early childhood education being to provide universally one year of preschool nationwide by 2020, and for those 'ready' regional areas to provide universal three year preschool programmes, meaning the urban area or cities. In accordance with the national plan, provincial and local level governments also set development goals of ECEC development based on 'local situations', with the targets for developed areas and urban cities higher than less developed areas and rural areas (Guizhou Province, Hebei province, Shaanxi Province , Hainan Province, Department of Education, 2011).

In order to narrow the regional disparities, the central government has increased the investment in ECEC development to rural areas and Western regions. Between 2010 and 2013, the central government invested 50 Billion RMB which was mainly used in relevant kindergarten expansion programmes in rural China, especially in Western areas. However, in China overall the public spending on ECEC has been kept at a lower rate. Between 2000 and 2008, the public expenditure on ECEC in China was below 1.3% of the total financial expenditure on education, and even up to 2010, it was still below 2%. The situation has improved since 2010 due to the release of a series of national plans for education reform, and in 2012, the public investment on ECEC was 3.23% of total public education expenditure, whereas the public spending on education was 4.28% of GDP (Yang, 2014).

2.3.2. Urban and Rural Disparities in Numbers

The urban and rural area disparity can be seen in various aspects of early childhood education development in China including the service accessibility, the ‘hardware’ environment (facilities and resources), and teachers’ development (staff training and qualifications). For example, the preschool attendance in rural China was only 35.6%, while the national average rate was 44.6% and the rate in urban China was 55.6% in 2007 (Pang, 2010). The three- years’ preschool attendance rate in rural China is much lower than in urban area, and especially far less than some large cities such as Shanghai, Beijing, Guangzhou, Nanjing, which normally have preschool attendance rates above 90%. Furthermore, even when children in rural China attended preschool centres, the quality and environment of preschool education they experienced was different from preschool education in urban China.

According to national education statistics reports between 2001 and 2012 (Ministry of Education, 2001-2012), kindergarten teachers' qualifications were much lower in rural areas than in urban areas. For example, in 2001, the majority of teachers in rural area (84%) were high school graduates or below, while only the remaining small proportion (16%) had associate degrees. In urban areas, however, more than 40% of kindergarten teachers had associate degrees (39%) or undergraduate degrees (4%) (Ministry of Education, 2001).

These urban and rural area disparities are still present although the gap has been decreasing. In 2012 in urban areas, almost three quarters of teachers had either an undergraduate degree (20%) or associate degree (54%), while a quarter were high school graduates (24%) or below high school (1%). However, in rural areas, half of teachers were high school graduates (44%) or below high school (7%), while other teachers mainly had an associate degree (42%) and few (7%) had an undergraduate degree or graduate degree (<1%) (Ministry of Education, 2012).

According to the national education statistics report up to 2009, the rural preschool centres had a less formal curriculum and inadequate learning and play materials (like toys, story books, videos and so on) compared to counterparts in urban areas (Ministry of Education, 2009). For example, in 2009, kindergartens in rural areas had 24,038,118 picture books in total and 3,163,450 tapes and videos which are usually regarded as learning and teaching materials for children. Comparatively, urban kindergartens had more than twice the amount of these materials (picture books: 42,538,583; videos and tapes: 6,444,553). Moreover, considering that the number of kindergarten classrooms in rural areas in 2009 was more than that in urban areas (rural: 389,299, urban: 227, 516) (Ministry of Education, 2009), the rural and urban disparities in learning and teaching materials for children are even bigger.

As explained earlier, due to the 'one child' policy and the economic system reform, the number of public ECEC service programmes in China had been reduced dramatically (Zhou, 2011). In the meantime, the number of private ECEC programmes had increased phenomenally (see Appendix x). Also,

Overall, considering the urban and rural area disparities in public spending on ECEC, the levels of staff qualifications and adequacy of learning resources for kindergarten children, there is growing concern that the big gap between rural and urban areas in ECEC development remains a huge challenge to providing universal high quality preschool education in China (Liu, Z. L., 2010c). This is of concern since preschool education is now an integral part of the education system in China, which many people believe should provide the basis for social equality through school and into adulthood (Cai & Feng, 2004; Ye, 2010; Zhu & Zhang, 2006; Zhou, 2008).

Summary

This chapter reviews the development of early childhood education and care (ECEC) in China in a historical context, in the contemporary context since the 1980s, and looks at current development trends since 2010. It describes the ECEC development in China through the lens of policies, the changes of kindergarten curriculum and practices, as well as the problems and challenges alongside the development. Overall, it is summarised that:

First, early childhood education and care in China is strongly influenced by the social economic, political and cultural changes and it has been experiencing great changes both in policy and practice, especially in the last three decades.

Second, China has made great strides in building the public and political profile of ECEC and put great efforts recently in boosting preschool centre participation nationwide. However, the public spending in ECEC development in China has been kept at a low level and especially the funding responsibilities between central government, provincial and local government in ECEC development are still not clearly defined.

Third, there have been and remain great regional and social economic disparities in development of ECEC in China. The development of ECEC in rural China is far behind the urban areas at various levels such as public spending, programmes accessibility, kindergarten facilities, resources and teachers education and so on. How those disparities will influence children's development in China is yet unclear but there is growing concern in China that these inequalities could lead to further development gap in education and even social inequality.

Fourth, early childhood education and care development in less developed regions and rural areas is one of the great challenges China facing at the moment. The policy and public spending preferences in China nowadays are for expanding centre-based preschool services in order to achieve the national goal. Little is known about the quality of these centre-based preschool programmes and there is growing concern that the programme quality cannot be maintained in expansion process.

Finally, it appears that the great societal interest in kindergarten has not been matched by interest in child care or nurseries for 0 to 3 year olds. Policy development for nurseries in China is relatively thin compared to the recent boom for kindergarten. As the main interest in this study is children in kindergarten, the development of childcare or nurseries services in China will not be discussed in more detail.

Chapter 3 Methodology

A two-year non-experimental longitudinal study was designed to address the questions specified in Chapter 1: *'In rural China do preschool centre experience and preschool home activities influence children's cognitive and social/behaviour development at school entry'* and if yes, *'how much do they contribute to children's development*'. This chapter describes the methodology that was used from the following aspects: selection of participants, procedure for data collection, measurements selection, analytic strategy, and the research ethics issues.

3.1 Participants

3.1.1 Selection of Preschool Centres

The current study was happened in Shandong, a coastal province of the People's Republic of China, and is part of the East China region. The X County in Shandong Province is the researcher's hometown and since some contacts have already been established there, it was considered to be a more practical choice to recruit participants and collecting data for this study.

The local preschool education administrator was interviewed and provided an overview of preschool centre development in the rural area in X County. The administrator then provided a list of 90 officially registered preschool centres in this area (14 are private centres). The study required that the centres differed in terms of quality and therefore all these centres were labelled with quality rankings of low, medium or high, based on the local education department's annual quality assessment system, with 30 in each category. The researcher was blind to the quality definition of each group and they were labelled as Group A, B and C. The researcher randomly selected 10 centres from each group to form the initial sample of 30 preschool centres. It was anticipated that not necessarily all centres would participate so a larger number than required was selected. After identifying the 30 preschool centres, it was found that two of them were hard to reach (geographically) due to the lack of public transport (the researcher also did not have a valid driving licence), four were going to combine into two preschool centres two months later as a part of preschool project of the local educational department (two centres are private), and another four were not sufficiently organized to participate (they were busy preparing for the annual autumn investigation from the local educational department). Of the ten centres which were not able to participate in the study, three were from Group A, four were from Group B, and three were from Group C. Later in the procedure, another centre from Group A stopped their involvement in the study due to the absence of a head teacher.

It was unclear whether the missing of these preschool centres can lead to sampling bias problems in this study. However, considering the number of missing centres in each group was nearly equal (missing: Group A = 4, Group B = 4, Group C = 3) and also due to the limited research resources and time available to researcher at that time, it was finally decided to recruit children and families from these 19 preschool centres (only one private centre), which were considered to be adequately representing the 90 preschool centres in X county.

3.1.2. Selection of Child and Family Participants

In each preschool centre, one or two classrooms were selected with children who were going to attend primary school one year later in September 2011(four centres have two classrooms). Furthermore, because each classroom had a different class size, instead of selecting all children from one classroom, at least one third of children in each classroom were randomly selected and their parents were sent the study information sheet and consent form (*N*=314). Overall, 95% of parents or guardians agreed to their child's participation in the study making the total number of participants 298. The distribution of participating children from 19 preschool centres can be seen in Appendix I.

3.2 Procedures

Information about the child and family was collected at two phases. Phase 1 was one year before the child's entry to primary school in September 2010, and Phase 2 was planned to be ideally immediately before primary school entry in August 2011. However, because of an outbreak of hand, foot and mouth disease (HFMD) between July and August in 2011, all preschool centres were closed and children stayed at home, meaning that it was hard to reach children at that time. Therefore, the second phase of data collection took place after children had entered primary school in September 2011. All the assessments were completed within one month of their primary school entry.

3.2.1 Preschool, One Year before School Entry (Phase 1)

In Phase 1 each child's parent or guardian was interviewed (either in the centre or at home) to collect information about the child, parents and family background characteristics. In addition, a child's out of school activities at home or elsewhere which might involve learning opportunities activities were reported by parent or guardian during the interview.

Information about each child's preschool experience was collected by researcher using standard observation scales, as well as interviewing centre staff. This included timing, duration, stability of preschool experience as well as preschool staff qualification and teaching experience. Standardised structured preschool quality rating scales were also used to assess preschool centre quality.

Children's school readiness, general cognitive abilities and social behaviour development were assessed in Phase 1 by researchers using standardised cognitive and social development measures at preschool centres.

3.2.2 School Entry (Phase 2)

One year after children's enrolment into the study, their cognitive and social development were assessed again using one-to-one testing and observations. The assessments took place in the primary school that the child had entered in September 2011. All the child assessments were finished within one month (ten days national holiday within this period was not included) after their primary school entry in order to minimise the influence of primary school on children's development. Furthermore, children's home learning activities as well as family income were reported by parents in Phase 2 in a self-report questionnaire.

3.3 Measures

3.3.1 Parents/Guardian Questionnaire

In order to collect children's demographic and background information, a semi-structured questionnaire was designed for this study. It included questions about child characteristics such as age, gender, birth weight, birth order, single child or not, health history, parents characteristics (marital status, educational history and qualifications, mother's age at the birth of the target child, work status), and family characteristics (family income, family structure and size). The child's parent/s or guardian was interviewed at preschool when they were sending or collecting their child or they were interviewed at home when they lived near the school. For those children who were living far away and whose parents were hard to reach a telephone interview was conducted. The details of the parent/guardian questionnaire can be seen in Appendix II.

3.3.2 Home Activities Questionnaires

Home activities differ from other family factors such as parents' educational qualifications, occupational status and family structure, being concerned with the learning environment provided for children in their home. Many studies suggested that parenting and children's activities in the early years have a powerful influence on children's development (Bradley et al., 2001; Bradley, 2002; Lugo-Gill & Tamis-LeMonda, 2008; McCartney, Dearing, Taylor, & Bub, 2007; Mclaughlin, Campbell, Pungello, & Skinner, 2007; Melhuish et al., 2001, 2008; Miller, Farkas, Vandell, & Duncan, 2014). Chinese literatures studying home learning environment are also influenced by those Western researches and generally described the home learning environment from the perspective home literacy and/or numeracy environment (Deng, Silinskasb, Wei., & Georgioud, 2015), or broadly in terms of the home learning activities (e.g. reading, writing, counting) and enriching life experience activities (such as going shopping and visiting libraries) (Sun, 2008; Li et al., 2013).

Using concepts from the early years home learning environment questionnaire developed by researchers in the UK Effective Provision of Preschool Education (EPPE) project (Melhuish et al., 2001, 2008), a questionnaire was designed for this study. The format was a semi-structured questionnaire for parent or guardian to complete during the interview. Questions covered the frequency with which children engaged in a number of activities such as: watching TV; playing with numbers; painting or drawing; teaching counting; teaching Chinese characters, Chinese Pinyin, songs, poems, rhymes; playing with friends at home; playing with friends at home or elsewhere; eating meals with family; shopping with parents; visiting relatives. The frequency of each activity is coded on a 7-point scale (1= never; 2=less often; up to 7 = every day). The frequency of TV watching and the typical sleep time were also asked.

At school entry (Phase 2), after analysing the Phase 1 home activities data, a short version of the home learning environment questionnaire which included eight significant home activities was produced. The details of the home activities rating questionnaires (Phase 1 and 2) are shown in Appendix II and III.

3.3.3 Preschool Centre Experience

<u>Timing, duration and stability</u>

The timing of preschool experience refers to the age of starting preschool. The duration is the time which children spent in preschool till the developmental assessment. The stability of preschool experience was defined in the study as whether a child changed centre or not after they first entered the preschool centre. The duration, timing and stability of children's preschool experience were reported by children's parents or guardians during the Phase 1 interviews.

<u>Quality</u>

A main focus of this study was to explore if the preschool quality difference could influence children's development at primary school entry. Two aspects of preschool centre quality were assessed,-process quality and structural quality.

Process quality

The process quality of the preschool centre emphasizes the actual daily experiences that occur, such as child-teacher interactions and the types of activities in which children are engaged. It is typically measured by observing children's experiences in the centres and classrooms and rating the multiple dimensions of the programme. In this study the widely used Early Childhood Environment Rating Scales-Revised (ECERS-R) (Harms et al., 1998) and the Early Childhood Environment Rating Scales-Extension (ECERS-E) (Sylva et al., 2003) was both used.

Early Childhood Environment Rating Scales (ECERS)

The Early Childhood Environment Rating Scale (ECERS) is a well-known rating scale for assessing early childhood environment. The revised version (ECERS-R) (Harms et al., 1998) contains inclusive and culturally sensitive indicators for many items. It consists of 43 items organized into 7 subscales: space and furnishings; personal care routines; language-reasoning; activities; interactions; programme structure; and parents and staff.

The ECERS-R has been used in many major studies in the US (such as NICHD SECCYD, Early Head Start Study) and the UK (such as the EPPE study). Also, it has been used in many other countries including Austria, Canada, Germany, Greece, Hungary, Iceland , Italy, Korea, Portugal, Singapore, Spain, Sweden, and Russia, either for research purpose or programme improvement. Despite the cultural differences between these countries, the ECERS, in translation or with minor adaptations, has been shown to produce reliable and valid ratings in each country and region (Clifford et al., 2010). Clifford and colleagues (2010) in an article reviewed the validity and the reliability of the ECERS-R in terms of test-retest reliability, internal consistency, and inter-rater reliability, predictive validity, concurrently validity and content validity. Overall, they concluded that the ECERS-R is a reliable and valid measurement of the early childhood environment.

The Early Childhood Environment Rating Scales-Extension (ECERS-E) (Sylva et al., 2003) was developed by the Effective Provision of Preschool Education programme (EPPE) researchers in the UK as an extension of the ECERS-R with a focus on educational activities in the early childhood environment. It consists of 4 sub-scales: literacy, mathematics, science and environment, and diversity. As the authors of this scale recommend (Sylva et al., 2003), it was used as a supplement to the ECERS-R. The structure of the ECERS-R and the ECERS-E are both shown in Appendix IV.

ECERS in China

In China, there are some quality- assessment systems. However, these systems were mainly developed by local education department for regulation or management purposes. Most of these systems were developed through theoretical deduction and experiences rather than based on any empirical evidence (Dai & Liu, 2003; Pan & Liu, 2010). Most importantly, there were few data on validity and reliability of these assessment systems thus it is considered not appropriate to use these assessing systems in this study.

The ECERS-R was translated into traditional Chinese in 2006 by Guo and Chan from Taiwan (Harms et al., 1998; translated by Guo & Chan, 2006), but there were no available translations in mainland China when this study was conducted in 2010.

However, there were a few studies in China used the ECERS-R as measurement of kindergarten environment, and they suggested that it is appropriately demonstrated the environment that children experienced in kindergartens. Researchers have used the ECERS-R in Beijing and other cities in China for large sample studies (Hu & Li, 2012; Hu & Roberts, 2013; Hu & Szente, 2009; Rao et al., 2012); thus the ECERS-R was known to be applicable in the Chinese context. Furthermore, because the aim of the study is to make within centre comparisons in China and not quality comparisons between countries samples, it was considered acceptable to use this scale. Also, because the four aspects of curriculum in ECERS-E scale - literacy, mathematics, science, and diversity - are also included in the curriculum in preschool centres in China, it was decided to use this scale to collect information on the quality of the curriculum.

Training procedure

The researcher attended a week-long training led by staff which used both the ECERS-R and ECERS-E in the EPPE study in the UK and passed a paper and pencil assessment of the scoring procedures. Next, after one week of training of using the ECERS-R and ECERS-E, the two observers who had independently scored the ECERS-R and ECERS-E compared their scores on the same observations. Hence reliability was established for ECERS-R in 6 centres and ECERS-E in 4 centres chosen randomly both from Greater London and Central London.

In this study, the reliability for two observers was computed on the basis of: a) where each observer scored exactly the same point on a scale and exact agreement within one point; b) a Kappa value was computed. Kappa is a statistic which measures the degree of agreement between two observers while allowing for the level of ‘chance’ agreement. The Kappa statistic is computed by the following formula:

$$\text{Kappa} = \frac{Ro - Rc}{1 - Rc}$$

Whereas Ro = proportion agreement observed;

Rc = proportion agreement that would occur by chance;

The inter-observer reliability for ECERS-R and ECERS-E, as well as for the subscales is shown in Table 3.1.

Table 3.1 Inter-Observer Reliability for ECERS-R and ECERS-E

ECERS-E subscales	*(%) Percent of agreement*	*Kappa*
Literacy	96%	.93
Mathematics	100%	1.00
Science & Environment	95%	.92
Diversity	100%	1.00
Overall	93%	.89
ECERS-R subscales	*(%) Percent of agreement*	*Kappa*
Space & furnishing	92%	.87
Language reasoning	92%	.87
Personal care routines	94%	.90
Activities	100%	1.00
Program Structure	100%	1.00
Parent & Staff	94%	.90
Overall	95%	.92

The ECERS-R inter-observer reliability based on the exact percent of agreement (within 1 point) was 0.95, and it ranged from 0.92 to 1.00 for seven subscales. The inter-observer reliability based on *Kappa* for ECERS-R was 0.92, and it ranged from 0.87 to 1.00 for the seven subscales. For the ECERS-E, the inter-observer reliability based on the exact percent of agreement was 0.93, and it ranged from 0.95 to 1.00 for four subscales; the inter-observer reliability based on kappa was 0.89, and it ranged from 0.92 to 1.00 for four subscales. Overall, this suggested that the two observers reached a high agreement between each other and the researcher was qualified to use both two scales.

Before the formal use of ECERS-R and ECERS-E in the target preschool centres in China, the researcher used them both in three other preschool centres in China, not included in the main study, to gain a better understanding of the Chinese version of both scales. Finally, these two scales were completed after no less than four hours in each classroom in targeted preschool centres.

Structural Quality

The structural features of a programme are thought to contribute to quality in more indirect ways than process features. In this study, it was assessed by collecting information on staff: child ratio, classroom size, staff qualifications and teaching experiences during staff interviews in the centres.

3.3.4 Child Outcomes

<u>Cognitive development</u>

Children's cognitive development was assessed twice in the study. The first assessment happened in Phase 1 while children were enrolled into the study at preschool, and the second assessment was happened in Phase 2 after they entered into primary school. The Bracken Basic Concept Scale-Revised (BBCS-R) (Bracken,

1998) was used to assess children's school readiness and general cognitive abilities in Phase 1. The Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) was used to assess children's cognitive development at school entry in Phase 2.

Bracken Basic Concept Scale-Revised

The BBCS-R (Bracken, 1998) is a widely recognized individually administered scale which measures the comprehension of 308 functionally relevant educational concepts in 11 subtests for children aged 2 years, 6 months through to 7 years, 11 months. It is a developmentally sensitive measure of children's basic concept acquisition and receptive language skills rather than only their knowledge of common vocabulary. Of the 11 subtests on the BBCS-R, the first six compose the School readiness Composite (SRC), which can be 'used to assess children's knowledge of those 'readiness' concepts that parents and preschool and kindergarten teachers traditional teach children in preparation for formal education' (Bracken, 1998b, p1). The detail descriptions of the BBCS-R are shown in Appendix V.

The reliability and validity characteristics of the BBCS-R are reported in the examiner's manual (Bracken, 1998b). In this section, the internal consistence reliability, test-retest reliability and the concurrently validity of its English version were specifically reported.

- The internal consistence reliability average across age levels on BBCS-R was between 0.91 and 0.98. Specifically, for age 5 groups it was between 0.93 and 0.99 and for age 6 groups was between 0.92 and 0.99.
- The test-retest reliability was between 0.78 and 0.88 (based on corrected r) for all subtests, and was 0.94 for the total test.

- For concurrent validity, it was reported that both the School Readiness Composite (SRC) and the total test scores on BBCS-R correlated strongly with the Wechsler Preschool and Primary Scales of Intelligence-Revised (WPPSI-R; Wechsler, 1989) verbal, performance, and full scale IQ (0.85, 0.76, and 0.88, and 0.82, 0.72, and 0.85, respectively) (Bracken, 1998b). Also, both SRC and the total test reported moderately to highly correlation with the Differential Ability scales (DAS; Elliot, 1990) which is an individually battery of cognitive and achievement tests for children. The correlations between SRC and Total Test scores and DAS verbal cluster, nonverbal cluster, and general conceptual ability (GCA) scores were strong (0.69, 0.72, and 0.79, and0 0.74, 0.80, 0.88, respectively) (Bracken, 1998).

Overall, this suggests that the BBCS-R is a reliable scale for screening children's school readiness and general cognitive abilities.

BBCS-R in China

There are English and Spanish versions of the BBCS-R but there was not a validated Chinese version available. However, the concepts in the scale are acquired in a developmentally predictable way that is consistent across cultures. Furthermore, some studies in China had translated and used this scale to predict children's school readiness, and they found it can predict school achievement in grade 1 in rural areas in China (Liu, 2008; Rao et al., 2012; Zhang, 2008). Thus, it was considered appropriate to use the BBCS-R, with minor changes to suit Chinese culture, E.g. USD to Yuan, and not use Letters scale. Finally there were 10 subtests in the scale which were used in the study and the first five subtests of the scale comprise the School Readiness Composite (SRC), which used to represent children's school readiness in Phase 1. The School Readiness Composite, together with the left 5 subtests comprised the BBCS-R overall score and it represents children's general cognitive abilities at preschool. Overall, in Phase 1, two cognitive outcomes were collected for each child: school readiness outcome represented by the BBCS-R School Readiness Composite (SRC) score and the general cognitive development represented by the BBCS-R overall score.

Training procedures

The researcher was firstly trained by a senior researcher who was using the BBCS-R in a well-recognised research programme in Britain in April 2010 to administer the English language version. After one week of material learning and past a paper test, the researcher used the scale in real situation as practice. After training in using BBCS-R on four children aged 5 to 7 from four families in England, two researchers reached high agreement between 0.95-0.99. The researcher checked the BBCS-R Chinese translation that was used in other programmes in China and practiced using the BBSC-R in Chinese to assess 5 year old children's school readiness in one preschool centre in Rural China. After the researcher was familiar with the BBCS-R in Chinese, another research assistant was trained by the researcher for a week in assessing preschool age children and they reached a high agreement with each other on assessing 10 preschool children in research area between 0.94 to 0.99, which suggested that the research assistant was familiar with the BBCS-R and able to use it in assessment. Finally, the formal assessment happened in a quiet environment in preschool centres; the BBCS-R School Readiness Composite was administered first and then the remaining subtests.

Wechsler Intelligence Scale for Children-Fourth Edition

Why use the WISC?

After analysing the BBCS-R data from Phase1, it was judged not sensible to repeat the measure when children were one year older, because there was a ceiling effect with scores skewed to the upper end of the scale. Therefore, the researcher needed to select another assessment scale, and chose the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) Chinese Version for Phase 2, because it was one of the very few assessment already adapted for use in China. The WISC-IV is containing 10 core subtests, and 5 additional subtests that can be summed to four indexes and one full scale IQ. The four indexes are Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI) and Process Speed Index (PSI) (see Figure 3.1).

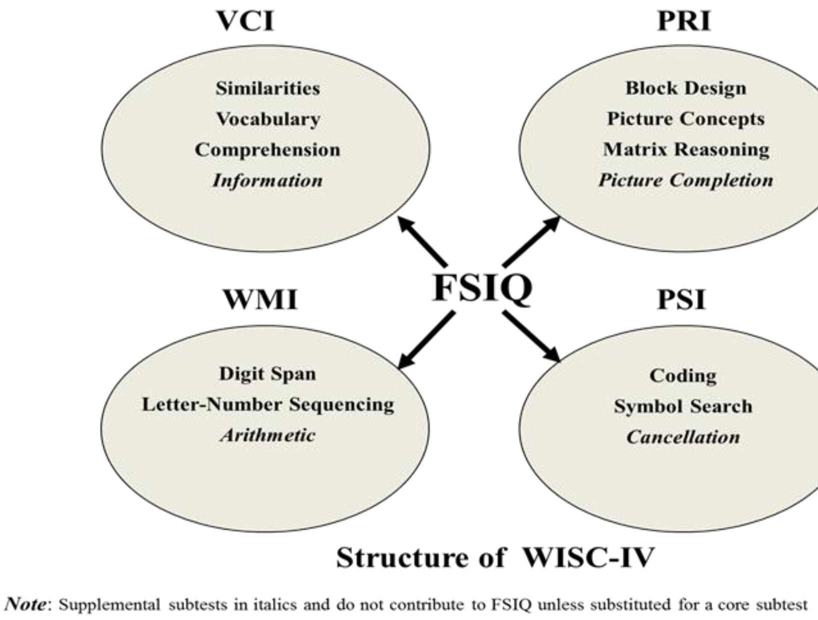

Figure 3.1. Overview of WISC-IV

In this study, the first two index scores (VCI and PRI) were used to represent children's verbal ability and nonverbal ability. Moreover, these two index scores could be combined together as a third index score: General Ability Index (GAI) that represents children's general cognitive ability which is less sensitive to the influence of working memory and process speed (Raiford et al., 2005) (see Appendix V).

WISC-IV in Chinese context

The Chinese version of WISC-IV was revised under a team led by Pro. H.C. Zhang from Beijing Normal University in China and obtained the certificate in 2007. The WISC-IV Chinese version reported moderate to high reliability for core subtest between 0.78 and 0.92, and for supplement subtest between 0.71 and 0.89 (based on corrected split-half co efficiency). The reliability for four index (combined) scores was between 0.87 and 0.97. For the validity of WISC-IV, the revised Chinese version followed most of the content of the scale and thus it also has high content validity with the WISC-IV English version. The WISC-IV Chinese version was also tested for structural validity by using factor analysis and they reported that the four domain factor structure was identified and was similar to the structure validity in WISC-IV English version (Zhang, 2009). Overall, this suggests that the WISC-IV Chinese version is consistent with the WISC-IV original version in terms of reliability and validity and thus it is a reliable and valid scale and appropriated to screen Chinese children's cognitive abilities in this study in Phase 2.

Training procedure

In June, 2011, the researcher attended the 5 days extensive WISC-IV training workshop in Zhuhai, China and received the certificate of WISC-IV assessment. Another research assistant was then trained by the researcher. The research assistant was asked to be familiar with the materials for a week and later passed a paper-pen test. Second, the research assistant practiced using the scale (only PRI and VCI) on several children aged 7 to 8. Third, the researcher and the research assistant together assessed 10 preschool children in the research area and reached good agreement with each other between 0.96 and 0.99 (Block design: 0.98, Similarities: 0.97, Picture concepts: 0.97, Vocabulary: 0.96, Matrix Reasoning 0.99, Comprehension 0.96) based on the intra-class correlation statistics. This suggested that the research assistant was familiar with the WISC-IV and was capable to use it. The research assistant helped with 60 children's assessment (around one fifth) in the sample. The children were assessed individually in a quiet environment either at home or in primary school. Finally, three cognitive outcomes were collected for each child in Phase 2 and, they were verbal comprehension, perceptual reasoning and general cognitive abilities represented by VCI, PRI and GAI scores on WISC-IV.

Social and behaviour development

The Strengths and Difficulties Questionnaires-Chinese Version (SDQ-C) was used to assess children's social/behaviour development in this study.

Strengths and Difficulties Questionnaires

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) is a brief behavioural screening questionnaire suitable for 4-16 year olds. Versions are available for parents and teachers. Both versions ask about 25 attributes, some positive and others negative which are grouped into 5 scales each with 5 items: 1) emotional symptoms; 2) conduct problems; 3) hyperactivity/inattention; 4) peer relationship problem; and 5) pro-social behaviour. The details of the SDQ can be seen on their website: www.sdqinfo.org/ or in Appendix VI.

The reliability and validity of the Strengths and Difficulties Questionnaire (SDQ) have been demonstrated in previous studies not only from UK (Goodman, 1997, 2001), but also from other countries such as Australia, Germany, Greece, Japan, Norway, Sweden, the US, as well as China (Burchinal et al., 2014; Du , Kou , Coghill, 2008; Giannakopoulos et al., 2009; Hawes & Dadds, 2004; Matsuishi et al., 2008; Palmieri & Smith, 2007; Smedje et al., 1999; Van et al., 2006; Woerner et al., 2002). Through its agreement with other screens such as CBCL/TRF and ASEBA, and the comparisons with clinical instruments, as well as the confirmatory factors analysis, the SDQ is shown to be an easy to use but also reliable and valid behaviour screen (Achenbach et al., 2008; Goodman & Scott, 1999; Janssen & Deboutte, 2009; Klasen et al., 2000; Palmieri & Smith, 2007; Syed et al., 2009; Van et al., 2008).

SDQ in China

The SDQ has been translated into Chinese and used in China and also reported with moderate reliability and validity (Du, Kou, & Coghill, 2008). Also, because it is easy to use (takes around 5 to 10 minutes to finish), it was decided to use the SDQ in this study to screen children's social behaviour development.

The SDQ was used twice in this study. In Phase 1 the SDQ teachers' version was used, completed by preschool teachers for the participating children in their classroom. It was used a second time at the beginning of children's Primary school entry. However, because the teachers of children in Grade 1 were not familiar with these children (less than one month in their classroom), it was not considered appropriate to ask them to assess children's social development. Therefore, instead of teachers' SDQ reports, children's parents were sent the questionnaire.

3.4 Analytic Strategy

The study design is guided by a bio-ecological theoretical perspective (Bronfenbrenner & Morris, 1998), in which development is viewed as the interactions, or proximal processes, that occur between individuals and their environment. The influence of these processes on child development varies as a function of individual characteristics (measured as child characteristics), environmental contexts (measured as parent, family characteristics, home learning environment and preschool environment), and the time periods in which these processes occur (measured at time points).Therefore, three sets of data that are produced:

- Background child, parent, family characteristics and preschool home activities;
- Preschool centre experiences (timing, duration, stability and quality of preschool); and
- Child cognitive and social/behaviour development outcomes assessed in Phase 1 and Phase 2.

3.4.1 Treatment of Missing Data-Multiple Imputation

As with all longitudinal studies, a challenge to this study was tracking children when they moved home or moved from preschool to primary school. It involved identifying the new school (either preschool or primary school) and establishing contacts with teachers in the new environment who have sufficient knowledge of the children in the study. This process inevitably resulted in some loss of data and the missing values can lead to bias and make the sample in difference from the population which it was drawn. Thus it is important to deal with the missing data problem in a way which reflects the populations of inference.

There are several ways to deal with missing values. Traditional methods were list wise and pair wise deletion (Croy & Novins, 2005; Jelicic et al., 2009), which eliminates cases with missing values from all analysis, or the latter excludes cases on an analysis-by-analysis basis. However, these methods were mostly criticised for their flaws in that their accuracy depends on the Missing Completely at Random (or MCAR) mechanisms (Little & Rubin, 2002; Rubin, 1976), which is clearly an overly restrictive assumption in all developmental research studies (Enders, 2013).

Multiple imputation (MI) (Rubin, 1987) has several advantages over other methods of dealing with missing data (Wayman, 2003). First, in multiple imputation missing values for any variable are predicted using existing values from other variables. Second, it accounts for missing data by restoring not only the natural variability in the missing data, but also by incorporating the uncertainty caused by estimating missing data. Third, in multiple imputation, the intention is not to 'guess' what a particular missing value might be but rather to create an imputed dataset which maintain the overall variability in the population while preserving relationships with other variables. Thus, the multiple imputation was conducted on the original dataset with missing values, and five completed datasets were computed and the later Multilevel Modelling (MLM) process were all based on the five completed imputed dataset.

3.4.2 Sequence of Analysis

The aim of this study was to explore the linkages between these three sets of data and by controlling for a number of selected child, parent, family characteristics, as well as children's home activities, to explore the relevance of children's preschool experiences (in terms of timing, duration, stability and quality) to children's cognitive and social/behaviour development at school entry. The analysis followed three steps:

First, descriptive analyses were conducted in order to describe central tendencies and variances for each variable. One-way ANOVAs were also conducted to explore the mean difference on developmental outcomes between groups, for categorical predictor variables.

Second correlations among sample characteristics, home environment, as well as preschool characteristics were examined in order to explore associations between them. Third inferential analyses were conducted on child's cognitive and social development outcomes. Correlations between sample characteristics, home environment, as well as preschool characteristics and development outcomes were examined first in order to differentiate predictor variables on child's outcome.

Third, in order to take account of the clustering in the data, multilevel analyses were used to partition the variance in the outcomes that is attributable to the preschool (level 2) and the individual child and family (Level 1).

3.4.3 Multilevel Modelling

This models the effects of clustering in the data (because children are nested in preschools) and is widely recognized as essential in analysing hierarchical data (Creemers, Kyriakides, & Sammons, 2010; Goldstein, 1995, 2003; Teddlie & Reynolds, 2000). Hence multilevel modelling (MLM) (Goldstein, 2003) with restricted maximum likelihood (REML) estimation was used to construct hierarchical two-level models (child nested within preschool) for children's outcomes accounting for selected child, family characteristics and home environment variables. Since only 4 out of 19 preschool centres in this study have children as participants from two classrooms, the classroom was therefore not treated as a third level as the sample size of classroom is not statistically adequate for multilevel modelling (Snijders, 2005).

There are several reasons why Multilevel Modelling (Goldstein, 2003) was considered the more appropriate analysis strategy in this study.

First, the 298 children and families are clustered in 19 preschool centres and therefore data are hierarchical; initially, simple regression was considered, but as Goldstein (1995, 2003) suggested, using standard regression to treat hierarchical data can lead to inaccurate estimation. Simple regression treated children between preschools as the same thus it usually underestimates the standard errors of regression coefficients: children's performances in the same preschool are more similar between each other than children within different preschools. Simple regression can lead to an overstatement of statistical significance in the result;

Second, using multilevel modelling can generalize the result to the whole population. In a multilevel model the groups in the sample are treated as a random sample from a population of groups, therefore, results found in the sample can inference to the population of the group.

Third, using multilevel modelling could simultaneously estimate the group effects as well as the group indicators effects. In this study it could differentiate the variances on outcome between children individual differences and preschools differences; even when there are not significantly differences between preschools (like on child perceptual reasoning outcomes in this case), it can still help to differentiate the predictors between preschool level and child individual level.

Therefore, Multilevel Modelling (MLM) was selected, and the MLM accounts for the missing data through Restricted Maximum Likelihood Estimates (RMLE) based on five completed imputed datasets from 298 children recruited for the study.

<u>Procedures of multilevel modelling</u>

There are seven child outcomes in this study: 1) school readiness at preschool; 2) general cognitive development at preschool; 3) social and behaviour development at preschool; 4) verbal abilities at school entry; 5) non-verbal abilities at school entry; 6) general cognitive abilities at school entry and; 7) social and behaviour development at school entry. The Preschool-Child two-level models were constructed for each of child outcomes and the processes are as following:

- Step one: build a null or empty model, which is the model without controlling for any predictor variables. In the null model, the variance on the child outcome can be differentiated between child level and preschool level;

- Step two: child level variables were tested separately as explanatory variables on child outcome, and those variables which were significantly associated with the outcome, or those which improved the model were added into the null model simultaneously as explanatory variables.

- Step three: preschool level variables was then added into the model first separately as explanatory variables, and then those that showed significant associations with the outcome were added into the model simultaneously.

Only predictor variables which showed significant associations with the outcome, or improved the model, were kept into the model.

- Fourth, progress models were built for development outcomes at school entry (Phase 2) by treating development outcomes at preschool, one year before school entry (Phase 1) as predictor variables, together with these child level and preschool level predictor variables in the model.

The Akaike's Information Criterion (AIC) (Akaike, 1974) is a measure of the relative goodness of fit of the statistical model. The strategy was to enter potential predictor variable into the model as explanatory variable and only keep statistically significant variables in the model. Significant predictor variables significantly improved the model fit with the data, which was tested by the χ^2 statistic. All the analyses were conducted in SPSS 20.

3.5 Research Ethics

The current study aimed to investigate the influences of children's preschool experiences on their cognitive and social development at school entry. This process involved assessing children's development, as well as home and preschool environment assessment.

Ethical approval was obtained from the Birkbeck, University of London Research Ethics Committee. In September, 2010, the researcher went to the study area ('X' County) and informed the local educational department of the research idea and gained permission to enter preschool and primary schools for research purpose. Next, the researcher interviewed head teachers in selected schools and explained the research purpose to them. They gave permission to enter selected classrooms for research purposes and informed the teachers in each classroom. Teachers in classroom helped with recruiting participant children and families. An information sheet explained the research idea to children's parents and they were asked if they would like their children to participate into the study. They were also informed that this study was a longitudinal study and asked if they would like to be contacted during the next assessment session probably one year later.

Chapter 4 Results

The main purpose of this study was to explore the associations between preschool centre experience and children's development at school entry. More specifically, the current study explored how preschool centre experience (in terms of timing, quantity, stability and quality) is relevant for children's cognitive and social development while at preschool (one year before school entry) and later at school entry, accounting for selected child and family characteristics, as well as the home environment. Therefore, the measures of child cognitive and social development are considered in terms of a range of predictor variables including child and family characteristics, the home environment and preschool characteristics.

This chapter has three sections:

1. The first section deals with descriptive analyses of child and family characteristics, the home environment, preschool characteristics, and cognitive and social development outcomes. Correlations between the sample characteristics and preschool characteristics are also reported.

2. The second section reports results for prediction of cognitive development outcomes at preschool (one year before school entry, Phase 1), and then at school entry (Phase 2).

3. The third section reports results for prediction of social development outcomes at preschool (one year before school entry, Phase 1), and then at school entry (Phase 2).

A brief summary of results is given at the end of each stage of analysis.

4.1 Section 1: Descriptive Analyses

4.1.1 Child, Parents and Family Characteristics

Table 4.1 presents the descriptive statistics for child, parent, and family characteristics of the sample.

In the study, 298 children from 19 preschool centres were enrolled in the study one year before their primary school entry and their mean age was 69 months (SD= 3.3 months; range: 60.60 to 76.47), 50.7% (*N*=151) are girls, and 59.7% (*N*=178) are 'single or only child' in the family. Of the 120 children with siblings, seventeen (14%) were the 'first child' in the family, ninety-nine (83%) children were the 'second child' and only four children were the 'third child' in the family. The mean birth weight of the children was 3347.17g and only eight children were low birth weight (less than 2,500g) in the sample. The mean maternal age at the birth of the index child was 28 years (SD= 4.3), range 22 to 42 years.

Regarding parents' educational background, most (74.2%) of the fathers had a secondary or primary school level education, whereas the remainder either had high school level education (20.3%) or a college degree (5.5%). Mothers with secondary or primary school level education were 72.4% of the sample, whereas 13.8% of mothers had high school level education and 3.8% had a college degree.

In Phase 1 at preschool, 61.1% of families reported that they earned less than ¥ 30,000 per year, some earned between ¥30,000 and ¥50.000 (27.2%) and some earned more than ¥50,000 (11.2%) per year. In Phase 2 at school entry, one year later, less than half (45.64%) reported earning less than ¥30,000 per year, while some earned between ¥30,000 and ¥50.000 (31.21%) or more than ¥50,000 (23.15%).

Only two children (0.7%) lived with a single parent. Less than half of the sample children (43.3%) were living in a nuclear family (living either with parents, 20.8%, or with parents and siblings, 22.5%). The remainder lived in extended families with grandparents (48.3%) or other relatives (2.3%) in addition to parents. Most (52.4%) were cared for by parents alone, while the remainder were either mainly cared for by grandparents (32.84%) or jointly cared for by grandparents and parents (14.76%). No family structure differences (nuclear family VS extended family) were detected for child age, birth weight, mothers' age, family income in Independent-Samples T tests. There was significant difference in paternal education for 'nuclear family' (M=2.12; SD=.72) and 'extended family' (M=2.30; SD=.65) structures; $t(288) = -2.26$, $p = .024$, as well as in maternal education (nuclear family: M=1.96; SD=.70; extended family: M=2.13; SD=.65; $t(287) = -2.141$, $p = .033$).

Child's mean age of starting preschool was 36 months (*SD*=7.2 months, range 15 to 59 months). The mean duration of preschool attendance up to Phase 1 was 34 months (*SD*= 7.6 months, range 13 to 56 months). Almost two thirds (61.7%) of the children were in the same preschool centre since beginning preschool.

Correlations between child, parent and family characteristics

The current study is an observational study of the participant children's development in natural settings, and there are inter-correlations between background factors (see Table 4.2).

Being an only child was positively and significantly associated with higher family income ($r = .143$, $p = .013$) and better educated parents (paternal education: $r = .196$, $p = .001$; maternal education: $r = .315$, $p < .001$).

Being an only child was negatively related to birth weight (*r*=-.141, *p*<.022), suggesting that single children in this sample were likely to have a lower birth weight than children with siblings. Also, it was negatively and significantly associated with mother's age (*r*=-.709, *p*<.001), indicating that a single child was more likely to have a younger mother.

Mother's age at index child's birth was negatively and significantly associated with parental education (paternal education: *r*=-.240, *p*<.001; maternal education: *r*=-.266, *p*=.008) and family income (*r*=-.163, *p*=.005), suggesting that children with an older aged mother at birth, were also likely with less educated parents with a lower income. Meanwhile, the annual family income was significantly and positively associated with higher parental education (paternal education: *r*=.210, *p*<.001; maternal education: *r*=.251, *p*<.001).

Table 4.1 Child, Parents and Family Characteristics

	N	*Valid %*	*Mean*	*SD*	*Min.*	*Max.*	*Missing*
Girl	151	50.7%					/
Single child	178	59.7%					/
Birth order							
1st child	195	65.4%					
2nd child	99	33.2%					
3rd child	4	1.3%					
Paternal education							
Primary school	28	9.7%					8 (5.5%)
Secondary school	187	64.5%					
High school	59	20.3%					
College or university	16	5.5%					
Maternal education							
Primary school	49	17.0%					9 (3.0%)
Secondary school	189	65.4%					
High school	40	13.8%					
College or university	11	3.8%					
Family annual income (Phase 1)							
Less than ¥10,000	31	10.4%					/
¥10,000-¥30,000	151	50.7%					
¥30,000-¥50,000	81	27.2%					
¥50,000 above	35	11.7%					
Family annual income (Phase 2)							
Less than ¥10,000	13	4.4%					/
¥10,000-¥30,000	123	41.3%					
¥30,000-¥50,000	93	31.2%					
¥50,000 above	69	23.2%					

Sample characteristics	*N*	*Valid %*	*Mean*	*SD*	*Min.*	*Max.*	*Missing*
Family structure							
Single parent	2	.7%					16(5.4%)
Parents &child	62	20.8%					
Parents & child & Sibling(s)	67	22.5%					
Parents & Child & grandparent (s)	112	37.6%					
Parents & child & sibling(s)& grandparent(s)	32	10.7%					
Other relatives	7	2.3%					
Main carer before preschool							
Grandparents	89	32.84%					27(9.1%)
Parents alone	142	52.40%					
Grandparents & parents	40	14.76%					
Stability							
No preschool change	184	61.7%					
Age in month (*P*1)	298		69	3.3	60.60	76.47	/
Age in month (*P*2)	298		80	3.5	70.67	87.50	/
Age of attendance	276		35.6	7.2	14.63	59.30	22(7.38%)
<= 2.5y	66	23.9%			14.63	30.97	
2.5 to 3y	93	33.7%			31.00	36.97	
3 to 3.5y	79	28.3			37.03	42.97	
> 3.5y	38	14.1			43.17	59.30	
Birth weight (g)	267		3347.19	508.91	1700	5000	31(10.4%)
Low birth weight (<2500g)	8						
Mother's age at birth of index child	298		28.06	4.32	22	42	

Table 4.2 Correlations among Child, Parents, and Family Characteristics

Sample characteristic	1	2	3	4	5	6	7
1Girl	1						
2 Single child	-.04	1					
3 Birth weight	-.11^{+}	-.14*	1				
4 Family income	.00	.14*	-.07	1			
5 Mother's age at child' birth	-.09	-.71***	.08	-.16**	1		
6 Paternal education	.01	.20**	-.02	.21***	-.24***	1	
7 Maternal education	-.04	.32***	.05	.25***	-.27**	.55***	1
8 Age	-.02	-.04	-.13*	-.03	.02	-.05	-.06

Note: + *p*<.10, **p*<.05, ***p*<.01, ****p*<.001

4.1.2 Home Activities

A range of home activities were reported by parents at Phase 1 and 2. In Phase 1, they were asked about 18 activities that might be associated with children's learning and social development. Some were individual activities, such as playing with friends, playing with numbers, watching TV, drawing at home, writing at home, and reading at home; some were more likely to involve parents, such as teaching Chinese characters, teaching counting, teaching writing, reading stories to child and teaching drawing. Also, some are more social based activities and some activities are more related to learning. At school entry (Phase 2), eight home activity variables were created. These including activities such as reading, counting, teaching Chinese characters, drawing activity, paying with friends, visiting relatives and the amount of books at home. The frequencies of these activities (1=never, 2=less often, up to 7= everyday) were reported by parents.

As shown in Table 4.3, in Phase 1, individual activities occurred with higher frequency: play with friends at home (*M*=5.69), play with friends elsewhere

(*M*=5.02), watching TV (*M*=5.27), reading at home (*M*=4.74), drawing at home (*M*=5.13) and writing at home (*M*=5.20), while parent involved activities happened less often: teaching drawing (*M*=3.83), teaching writing (*M*=4.69), teaching counting (*M*=4.94), teaching Chinese characters (*M*=4.45), and teaching poem or rhyme (*M*=3.91).

More specifically, almost ninety percent of children (88.9%) had a regular bedtime, more than two thirds of children (69.5%) had regular TV watching, and most children (87.1%) ate with their parents every day. Moreover, playing with friends either at home or elsewhere was common. More than ninety percent of children (91.7%) were playing with friends at home 'several times a week' or more, and 82.7% of them were playing with friends somewhere else at similar frequency. More than a quarter (27.5%) visited relatives at least once a week. The most frequent learning oriented activities were drawing at home (73.7% at least once a week) and reading at home (73.0% at least once a week). Teaching poems or songs, and teaching Chinese characters were less frequent (see Appendix VII for more details).

At school entry, Phase 2, counting (*M*=5.59), teaching Chinese (*M*=5.39) and playing activities (*M*=5.86) happened more frequently than other activities such as visiting relatives (*M*=3.73), reading (*M*=4.16), and go shopping (*M*=4.21). Half of the children had more than 5 books at home (See Table 4.4). More precisely, more than a quarter of the children (28.7%) had reading activity less than once or twice a month. Less than a quarter of the children (24%) visited relatives less than once or twice a week at Phase 2. One fifth (19.9%) had drawing activity at home once or twice a month or less often. Playing with friends happened more frequently (almost 90% once or twice a week or more frequently) (see Appendix VII for further details).

Table 4.3 Descriptive Statistics for Home Activities at Preschool

Home activities	*Valid*	*Missing*	*Mean*	*SD*	*Range*
Playing with friends at home	277	21	5.69	1.453	2-7
Playing with friends elsewhere	277	21	5.02	1.574	2-7
Eating with family	276	22	6.57	1.224	2-7
Visiting relatives	276	22	3.58	1.162	1-7
Go shopping	276	22	3.91	1.350	2-7
Watching TV	276	22	5.27	1.896	1-7
Reading at home	276	22	4.74	1.872	1-7
Drawing at home	276	22	5.13	1.649	1-7
Writing at home	276	22	5.20	1.683	1-7
Play with numbers	276	22	4.13	1.897	1-7
Be reading with parents	276	22	4.30	1.718	1-7
Teaching drawing	276	22	3.83	1.744	1-7
Teaching writing	276	22	4.69	1.738	1-7
Teaching counting	276	22	4.94	1.718	1-7
Teaching Chinese characters	276	22	4.45	1.813	1-7
Teaching poem or rhythms	276	22	3.91	1.673	1-7
Home activities	*Frequency*	*%*	*Missing (%)*		
Regular TV watching?	85	30.5%	19 (6.4)		
Regular sleeping time?	31	11.1%	19 (6.4)		

Table 4.4 Descriptive Statistics for Home Activities at School Entry

Home activities	*N*	*Missing*	*Mean*	*SD*	*Range*
Reading stories	235	63	4.16	1.668	1-7
Counting activities	235	63	5.59	1.384	1-7
Teaching Chinese	235	63	5.39	1.607	1-7
Drawing activities	235	63	4.90	1.615	2-7
Playing with friends	235	63	5.86	1.381	1-7
Visiting activities	235	63	3.73	1.245	1-6
Go shopping	235	63	4.21	1.205	1-6
Number of books at home	*Frequency*	*%*	*Missing*		
None	5	2.2%	68 (22.8%)		
One or two	31	13.5%			
Three to five	73	31.7%			
Six to ten	52	22.6%			
More than ten	69	30.0%			

<u>Data reduction</u>

Parents reported on 18 home activities at preschool (one year before school entry, Phase 1) and 8 home activities at school entry (Phase 2). These home activities were analysed using a principal components analysis with varimax rotation to reduce the number of variables and to determine whether certain activities formed a factor and could be grouped together.

Four factors were extracted that accounted for almost 60% of the variability at Phase 1 and three factors were exacted that accounted for approximately 68% of the variability at Phase 2, indicating that the four- and three- factor solution was a good description of the data. Therefore, the four factors of the home environment at Phase

1 were labelled as: 1) learning activities, 2) family activities, 3) peer social activities, and 4) regularity. The three factors of the home environment at school entry (Phase 2) were labelled as: 1) parents teaching activity; 2) child individual learning activities, and 3) family activities. Cronbach's alphas for summed scales based on these factors were acceptable, ranging from .56 to .91. Further details of the data reduction procedures can be seen in Appendix VIII.

Correlations between home activities at Phase 1 and 2

As shown in Table 4.5, one aspect of home activities at Phase 1-learning activities-was significantly and positively associated with Phase 2-parent teaching activity (r=.260, p<.001) and individual learning activities (r=.202, p=.003). Also, family activities at Phase 1 was significantly and positively associated with Phase 2 individual learning activities (r=.165, p=.015) and family activities (r=.255, p<.001). Other correlations were not significant.

Table 4.5 Correlations between Home Activities at Phase 1& 2

	Phase 1				Phase 2		
Home activities	1	2	3	4	5	6	7
Phase 1							
1Learning activities	1						
2 Family activities	.00	1					
3 Peer social activities	.00	.00	1				
4 Regularity	.01	.00	-.01	1			
Phase 2							
5 Parent teaching activity	.26***	.06	.05	.07	1		
6 Individual learning activities	.20**	.17*	-.02	.12	.01	1	
7 Family activities	.06	.26***	-.03	.01	.04	-.01	1

Note: *p<.05, **p<.01, ***p<.001

Correlations between sample characteristics and the home activities

Table 4.6 presents the correlations between child, parent, family characteristics and home activities. Home activity at Phase 1-*regularity*- was negatively and significantly associated with single child (r=-.131, p=.030) and birth weight (r=-.161, p=.009) suggesting that being a single child or having a heavier birth weight were associated with being less likely to have regular TV watching or bedtime.

Family income was significantly and positively associated with home activities in Phase 1-family activities (r=.125, p=.037), as well as Phase 2-parent teaching (r=.141, p=.033), individual learning (r=.186, p=.005) and family activities (r=.132, p=.046) suggesting that children from higher income families had such activities at home more frequently than children from lower income families.

Paternal education was significantly and positively associated with activities at Phase 1:-learning activities (r=.119, p=.048), family activities (r=.241, p<.001), as well as at Phase 2:- individual learning (r=.194, p=.003) and family activities (r=.237, p=.000) suggesting that children with better educated fathers engaged in learning activities and family activities more often both at Phase 1 and 2 than children with less educated father. Also, maternal education was significantly and positively associated with family activities both at Phase 1 and 2 (Phase 1: r=.148, p=.014; Phase 2: r=.145, p=.029). Mother's age at the child's birth was negatively and significantly associated with family activities both at Phase 1 and 2 (Phase 1: r=-.120, p=.046; Phase 2: r=-.157, p=.017) indicating that children with an older mother were likely to have family activities less often than children with a younger mother. In addition, no family structure differences (nuclear family vs extended family) were detected for aspects of home activities in Independent-Samples T tests.

Table 4.6 Correlations between Child, Parents, Family Characteristics and Home Activities

	One year before school entry (Phase 1)				At school entry (Phase 2)		
	Learning activities	Family activities	Peer activities	Regularity	Parent teaching	Individual learning	Family activities
Age	-.09	.07	-.01	.08	.07	-.00	-.02
Gender	.03	.00	.05	-.02	-.03	-.08	-.03
Single child	.08	-.09	-.06	.13*	-.02	-.02	-.06
Birth weight	.04	$.11^{+}$	-.05	-.16**	-.10	.01	-.04
Family income	.07	.13*	-.01	.09	.14*	.19**	.13*
Paternal education	.12*	.24***	-.07	-.03	.10	.19**	.24***
Maternal education	.09	.15*	-.05	-.01	.09	$.12^{+}$	.15*
Age of attendance	-.06	-.06	-.06	.06	-.04	-.09	-.07
Change preschool	.05	.03	$.11^{+}$	-.03	.05	-.03	-.01
Mother's age at child's birth	$.11^{+}$	-.12*	-.03	.08	-.03	.02	-.16*

Note: $^{+}p<.10$, $*p<.05$, $**p<.01$, $***p<.001$; Gender: (0=girl; 1=boy)

4.1.3 Preschool Characteristics

Table 4.7 presents descriptive statistics for preschool characteristics. The mean group size in preschool centre classrooms was 38 (*SD*= 8, range 23 to 50). The mean staff: child ratio was 1:25 (range 1:13 to 1:40). More than half (56.7%) of the children had teachers with less than 10 years of teaching experience, while the others had teachers either with more than 20 years' experience (25.8%) or with teaching experiences between 10 to 20 years (17.4%). Almost half of the children (49.7%) had preschool teachers with secondary school level education background, while the remainder had teachers with high school background (12.1%) or college background (31.9%).

The mean quality of the preschool centres based on ECERS-R overall score was below the midpoint of the scale at 3.17 (*SD*= 0.63, range 2 to 4). Of seven subscales in ECERS-R, the subscale-*Interactions*-had the highest mean score: *M*=3.62 (*SE*=.62, range 2 to 5), and the subscale-*Programme Structure*-had the lowest mean score: *M*= 2.39 (*SE*=.45, range 2 to 3).

The mean quality of preschool centres based on the ECERS-E overall score was lower at 3.10 (*SD*= 0.68, range 2 to 4). Of the four subscales in ECERS-E, subscale-*Math*- had the highest mean score: *M*=4.22 (*SE*=.60, range 3 to 5), and the subscale-*Diversity*- had the lowest mean score: *M*=1.54 (*SE*=.55, range 1 to 3). The Frequency distribution on the ECERS-R and ECER-E can be seen in Appendix IX.

Standardized ECERS-R and *ECERS-E* scores were created with mean scores equal to zero and standard deviation equal to one, and they were used in later univariate and multivariate analysis.

Table 4.7 Preschool Centre Characteristics

Preschool characteristics	*Percent*	*Mean*	*SD*	*Range*
Group size	/	38	8	23-50
Staff: child ratio	/	1:25	1:7	1:13-1:40
1:13-1:20	32.2%			
1:23-1:25	36.4%			
1:28-1:40	33.2%			
Teaching experience				
Less than 5 years	20.8%			
5-9 years	35.9%			
10-20 years	17.4%			
More than 20 years	25.8%			
Teachers' qualification				
Secondary school	49.7%			
High school	12.1%			
Professional training in college	31.2%			
Other subjects training in college	7.0%			
Total ECERS-R		3.17	.63	2-4
Space and Furnishings		3.16	.87	3-5
Personal Care Routines		3.47	.69	2-5
Language-Reasoning		3.28	.63	2-4
Activities		2.89	.69	2-4
Interactions		3.62	.79	2-5
Program Structure		2.39	.45	2-3
Parents and Staff		3.38	.88	2-5
Total ECERS-E		3.10	.68	2-4
Literature		3.52	.74	2-5
Math		4.22	.60	3-5
Science		3.11	.99	2-5
Diversity		1.54	.55	1-3

Correlations between preschool centre characteristics

Table 4.8 presents the correlations among preschool centre characteristics.

Group size in the classroom was positively and significantly associated with teachers' qualifications, preschool quality based on ECERS-R and ECERS-E, indicating that children from a larger group were likely to be taught by better qualified teachers and be in higher quality centres. Teachers' qualification was positively and significantly associated with preschool quality based on ECERS-R and ECERS-E indicating that children who taught by better qualified/educated teachers were also likely to attend a higher quality centre in this sample.

Teachers' teaching experience was negatively associated with their qualifications, group size, and staff: child ratio as well as preschool quality based on ECERS-R and ECERS-E, suggesting that preschool teachers with fewer years of teaching experience were likely to be better qualified, to be in charge of a larger classroom group size, and have higher quality ratings. Furthermore, preschool quality, as measured by ECERS-R, was highly related to preschool quality based on ECERS-E.

Table 4.8 Correlations between Preschool Centre Characteristics

Centre characteristics	1	2	3	4	5
1 Group size	1				
2 Staff: child ratio	-.04	1			
3 Teachers' experience	-.24***	-.16**	1		
4 Teachers' qualification	.63***	-.10^{+}	-.16**	1	
5 ECERS-R	.30***	.04	-.22***	.65***	1
6 ECERS-E	.51***	.09	-.39***	.70***	.89***

Note: ^{+}p<.10, *p<.05, **p<.01, ***p<.001

Correlations between sample and preschool centre characteristics

Family income was negatively associated with teachers' years of experience (*r*=-.138, *p*<.05) but was positively and significantly associated with group size (*r*=.229, *p*<.001), teachers' qualification (*r*=.243, *p*<.001), and preschool quality based either on ECERS-R (*r*=.222, *p*<.001) or ECERS=E (*r*=.270, *p*<.001), indicating that children from higher income families were likely to attend a higher quality preschool based on the ECERS-R and ECERS-E, to be in a bigger classroom group and to be taught by teachers with less years of experience. Parental education also showed the similar pattern.

Child's age of entry to preschool was negatively and significantly associated with family income (*r*=-.190, *p*=.002) and approached significance for father's education (*r*=-.116, *p*=.056), suggesting that children who attended preschool at an earlier age were likely from higher income families with better educated father.

Age of entry to preschool was negatively associated with group size (*r*=-.166, *p*=.006), teachers' qualification (*r*=-.202, *p*<.001), as well as preschool quality based on ECERS-*R* (*r*=-.152, *p*=.012) and ECERS-E (*r*=-.167, p=.006) (see Table 4.9), indicating that children who started preschool at an earlier age were likely to attend a centre with better qualified teachers, and were more likely to be in bigger groups with higher quality based on the ECERS-R and ECERS-E.

Correlations between home activities and preschool centre characteristics

There were weak associations between aspects of home activities at Phase 1- Individual learning activities and regularity-with preschool centre characteristics. Group size in classroom was positively and significantly associated with more frequent individual learning activities at school entry (Phase 2) (r=.14, p<<.05).

Teachers' qualification was significantly and positively associated with family activities at preschool (Phase 1) (*r*=.148, *p*=.014), as well as parent teaching activity (*r*=.136, *p*=.040) and individual learning activities (*r*=.203, *p*=.002) at school entry.

Preschool quality (based on the ECERS-R and ECERS-E), were both significantly and positively associated with family activities in Phase 1 and individual learning activities in Phase 2. Furthermore, preschool quality based on the ECERS-R was also significantly and positively associated with family activities in Phase 2.

Overall this suggested that children in higher quality preschool settings based on the ECERS-R or ECERS-E assessment were also more likely to be involved in family activities in both Phase 1 and 2, as well as more often individual learning activities in Phase 2.

Table 4.9 Correlations between Child, Family Characteristics and Preschool Centre Characteristics

	Girl	Single child	Birth weight	Family income	Mother's age	Paternal education	Maternal education	Age
Age of attendance	.06	.08	-.06	-.19**	$.10^{+}$	$-.12^{+}$	-.09	.13*
Changing centre	.07	-.00	.13*	.08	.02	.02	.12*	-.04
Staff: child ratio	.03	.01	.13*	-.14*	.05	-.13*	-.01	-.06
Teachers' experience	.04	.09	.04	-.14*	-.02	-.09	$-.10^{+}$	.02
Teachers' qualification	.00	-.03	.01	.20***	.02	.28***	.19***	.05
ECERS-R	.08	.04	-.02	.22***	.09	.23***	.14*	.08
ECERS-E	.06	-.00	-.02	.27***	.08	.24***	.19***	.07
Group size	.00	.01	$-.10^{+}$	.23***	-.01	.19***	.18**	.02

Note: $^{+}p<.10$, $*p<.05$, $**p<.01$, $***p<.001$

Table 4.10 Correlations between Preschool Centre Characteristics and Home Activities

	At preschool, one year before school entry (Phase 1)				At school entry (Phase 2)	
	Learning activities	Family activities	Peer activity	Regularity	Parent activity	Learning activities	Family activities
Group size	-.01	.10^{+}	-.15*	.06	.08	.14*	.12^{+}
Staff: child ratio	-.06	.05	-.03	.03	-.22***	-.04	.02
Teachers' experience	-.08	-.09	-.01	.01	.01	-.15*	-.05
Teachers' qualification	.04	.15*	.02	.05	.14*	.20**	.11^{+}
ECERS-R	.04	.24***	.11^{+}	.09	.08	.27***	.13*
ECERS-E	-.04	.26***	.02	.07	.11^{+}	.24***	.10

Note: ^{+}p<.10, *p<.05, **p<.01, ***p<.001

4.1.4 Child Outcomes

Cognitive development outcomes

Phase 1: One year before school entry

The Bracken Basic Concept Scale-Revised (BBCS-R) (Bracken, 1998) was used in Phase 1, one year before their primary school entry, to provide measures of children's school readiness and general cognitive ability.

School readiness

The average school readiness score was 58.89 (*SD*= 6.78, range 29.00 to 71.00). The distribution of school readiness scores was approximately normal with a slight negative skew (see Table 4.11). Children's school readiness scores in the BBCS-R (Bracken, 1998) are usually recorded as age standardized scores. However, there are as yet no age standardized norms for Chinese children. Therefore age standardized school readiness scores were created by regressing raw SRC score against age and the standardized child level residuals were used as age standardized scores, with a mean of zero (SD=1; range -4.50 to 1.92), and were used in all subsequent analyses.

General cognitive ability

The average General Cognitive Ability (GCA) score of BBCS-R was 221.45 (*SD*=35.18, range 113.00 to 280.00), with a slight negative skew (see Table 4.11). Again, age standardized BBCS-R scores were created by regressing BBCS-R raw scores against age and the standardized child level residual were used as age standardized BBCS-R scores, with a mean of zero (SD=1; range -3.24 to 1.85) and were used in the inferential analyses.

Phase 2: at school entry

The Wechsler Intelligence Scale for Children® — Fourth Edition (WISC-IV) Chinese Version (Wechsler, 2008) Verbal Comprehension Index (VCI) and the Perceptual Reasoning Index (PRI) subscales were used as measures of verbal and non-verbal cognitive ability at school entry. These measures were also combined to give a General Ability Index (GAI). The children's mean age was 80 months old (*SD*=3.4 months, range 70.67 to 87.50 months) at school entry.

Verbal ability

The average Verbal Comprehension Index (VCI) score was 31.83 (*SD*=7.18; range 18.00 to 54.00), with a slight positive skew (see Table 4.11). As with other cognitive outcomes age standardized VCI scores were created by regressing WISC-VCI raw scores against sample children's ages and the standardized child level residuals were used as age standardized VCI scores. The age standardized VCI scores had a mean of zero (*SD*=1; range -2.20 to 3.25), and were used in all subsequent analyses.

Non-verbal ability

The average Perceptual Reasoning Index (PRI) raw score was 42.82 (*SD*=12.33, range 11.00 to 86.00), with a slight positive skew (see Table 4.11). Again, the Age standardized perceptual reasoning scores were created by regressing WISC-PRI raw scores against the children's ages in Phase 2. The age standardized scores had a mean of zero (SD=1; range -2.88 to 3.42), and were used in all subsequent analyses.

General cognitive ability

The average General Ability Index (GAI) raw score was 74.75 (*SD*=16.16, range 39 to 125), with a slight positive skew (see Table 4.11).The age standardized GAI scores were created by regressing GAI raw scores against children's ages. The age standardized GAI scores ranged -2.52 to 3.01 and were used in subsequent analyses.

Social development outcomes

Social development at preschool (Phase 1)

Children's social and behaviour development at preschool, one year before school entry (Phase 1) was measured by the Strength and Difficulties Questionnaire (SDQ) (Goodman, 1997), which was completed by preschool teachers. The children's mean age was 69 months (*SD*=3.3 months, range 60.60 to 76.47 months). It is important to note that for emotional symptoms, conduct problems, hyperactivity and peer relations problems, a higher score on each outcome indicates more problems, whereas a high score on prosocial behaviour indicates more positive behaviours. All five social behaviour outcomes showed a degree of skew that is often associated with behavioural and attitude rating scales. The skew is most marked for emotional symptoms and conduct problems (see Table 4.11).

Social development at school entry (Phase 2)

Children's social and behaviour development at school entry (Phase 2) was also measured by the Strength and Difficulties Questionnaire (SDQ) (Goodman, 1997) but the parent report version. In addition to these five scales, an extra 15 items were added to the parent report version, related to children's behaviour development in terms of cooperation, behavioural-regulation and emotional dysregulation. Again the eight social behaviour outcomes showed a degree of skew which is often associated with behavioural and attitude rating scales (see Table 4.11). The Frequency distribution on the teacher- and parent- SDQ for sample children can be seen in Appendix X.

Table 4.11 Descriptive Statistics for Children's Development Outcomes at Preschool, One Year before School Entry, and at School Entry

Outcomes	*N.*	*Missing*	*Mean (sd)*	*Range*	*Skew (se)*	*Kurtosis (se)*
Cognitive development (*Phase 1*)						
Bracken School Readiness	298	2	58.89 (6.78)	29-71	-1.13 (.14)	2.59 (.28)
Bracken General Cognitive Ability	298	5	221.45(38.18)	113-280	-.82 (.14)	.07 (.28)
Verbal ability	298	30	31.83 (7.18)	18-54	1.02 (.15)	.93 (.30)
Cognitive development (*Phase 2*)						
Non-verbal ability	298	30	42.82 (12.32)	11-86	.19 (.07)	.15 (.30)
General cognitive ability	298	30	74.75(16.16)	39-125	.37 (.15)	.04 (.30)
Social development ***(****Phase 1* ***)***						
Emotional symptoms	298	32	.84 (1.17)	0-7	1.78 (.15)	3.70 (.30)
Conduct problems	298	33	.96 (1.03)	0-7	2.09 (.15)	7.25 (.30)
Hyperactivity	298	32	2.53 (2.19)	0-10	.92 (.15)	.53 (.30)
Peer problems	298	32	1.83 (1.36)	0-7	.61 (.15)	.04 (.30)
Prosocial behaviour	298	32	7.20 (2.04)	1-10	-.33 (.15)	-.44 (.30)
Social development (Phase 2)						
Emotional symptoms	298	63	1.41 (1.50)	0-7	.86 (.17)	.27 (.33)
Conduct problems	298	63	1.40 (1.39)	0-10	2.28 (.17)	8.67(.33)
Hyperactivity	298	63	2.97 (2.11)	0-10	.86 (.17)	.31 (.33)
Peer problem	298	63	3.63 (1.08)	2-7	.72 (.17)	.34(.33)
Prosocial behaviour	298	63	7.67 (1.72)	1-10	-.62(.17)	.61 (.33)
Behavioural-regulation	298	63	6.71 (1.85)	2-10	-.13 (.17)	-.51 (.34)
Cooperation	298	63	7.23 (1.88)	2-10	-.45 (.17)	-.42 (.34)
Emotional dysregulation	298	63	2.39 (1.97)	0-9	.74 (.17)	-.09 (.34)

Correlations between cognitive outcomes

Children's school readiness and general cognitive ability at preschool (Phase 1) were significantly and positively associated with each other (r=.797, p<.001). Children's verbal ability, non-verbal ability and general cognitive abilities at school entry (Phase 2) were also significantly and positively associated with each other (see Table 4.12). Furthermore, children's school readiness and general cognitive ability in Phase 1 and children's verbal ability, non-verbal ability and general cognitive ability at school entry (Phase 2) were significantly and positively associated with each other showing that children with better cognitive outcomes in Phase 1 were also likely on average to have better cognitive outcomes in Phase 2 at school entry (see Table 4.12).

Table 4.12 Correlations between Cognitive Outcomes at Preschool, One Year before School Entry, and at School Entry

Cognitive outcomes	1	2	3	4	5
Phase 1					
1 School readiness	1				
2 General cognitive ability	.80***	1			
Phase 2					
3 Verbal ability	.45***	.46***	1		
4 Nonverbal ability	.45***	.44***	.33***	1	
5 General cognitive ability	.54***	.54***	.70***	.91***	1

Note: ^{+}p<.10, *p<.05, **p<.01, ***p<.001

Correlations between aspects of social development

Among the five aspects of teacher report behaviour outcomes at preschool (Phase 1), emotional symptoms were not significantly associated with conduct problems (r=-.034, p=.586) and prosocial behaviour (r=-.049, p=.430). Other factors were all significantly associated with each other. Specifically, the four problem aspects-emotional symptoms, conduct problems, hyperactivity and peer problems - were all significantly and negatively associated with prosocial behaviour (see Table 4.13).

Table 4.13 also presents the correlations between the eight factors of parents report social development outcomes at school entry (Phase 2). Of these eight factors, peer problems was significantly, positively associated with emotional symptoms (r=.136, p=.048), and none of the other factors was associated with peer problems. Children's emotional symptoms were not significantly associated with prosocial behaviours, behavioural-regulation and cooperation, but were significantly associated with the other factors. Children's emotional dysregulation was also not significantly associated with prosocial behaviours.

Correlations between Phase 1 and 2 were also calculated. Emotional symptoms as reported by parents at Phase 2 was negatively and significantly associated with conduct problems (r=-.171, p=.019) and hyperactivity behaviour (r=-.175, p=.016) in Phase 1. Hyperactivity behaviour at Phase 2 approached significance with conduct problems (r=.126, p=.084) and hyperactivity behaviour (r=.142, p=.051) as reported by preschool teachers at Phase 1. Peer problems reported by parents at school entry (Phase 2) was significantly and positively associated with peer problems at Phase 1 as reported by preschool teachers.

Table 4.13 Correlations between Social Development Outcomes at Preschool (Teacher Report), and at School Entry (Parent Report)

Social development	one year before school entry (Phase 1)					at school entry (Phase 2)						
	1	2	3	4	5	6	7	8	9	10	11	12
Phase 1												
1 Emotional symptoms	1											
2 Conduct problems	-.03	1										
3 Hyperactivity	.14*	.50***	1									
4 Peer problems	.24***	.24***	.24***	1								
5 Prosocial behaviour	-.05	-.48***	-.47***	-.33***	1							
Phase 2												
6 Emotional symptoms	.03	-.17*	-.18*	-.01	.11	1						
7 Conduct problems	-.09	.06	-.06	.01	.11	.29***	1					
8 Hyperactivity	.01	.13	.14^{+}	.09	-.04	.24***	.43***	1				
9 Peer problems	.07	.05	.05	.15*	.03	.14*	.04	.08	1			
10 Prosocial behaviour	.14*	.09	-.01	-.02	-.12	-.13	-.31***	-.28***	-.07	1		
11 Behavioural-regulation	.05	.04	-.04	-.01	.03	-.05	-.20**	-.37***	.03	.48***	1	
12 Cooperation	.07	-.04	-.06	-.08	-.01	-.07	-.34***	-.40***	-.08	.63***	.59***	1
13 Emotional dysregulation	-.03	-.04	-.06	.06	.05	.31***	.40***	.40***	.04	-.09	-.16*	-.23**

Note: $^{+}p<.10$, $*p<.05$, $**p<.01$, $***p<.001$

4.2 Section 2: Analysis of Cognitive Development

4.2.1Preliminary Analyses

Pearson product moment correlations were used to explore the associations between child, family characteristics, home activities, preschool characteristics and children's cognitive development outcomes at preschool (one year before school entry, Phase 1), and at school entry (Phase 2). One way ANOVAs with the categorical variable as the between-subject variable were conducted to explore the mean difference on developmental outcomes between groups for categorical variables.

Child, parents and family characteristics

Being a girl was significantly and positively associated with a higher school readiness (r=.177, p=.002) and general cognitive ability (r=.116, p=.046) score at Phase 1. No significant associations were detected between gender and children's verbal ability, non-verbal ability and general cognitive ability at school entry.

Age of preschool attendance showed weak but significant associations with children's verbal ability (r=-.133, p=.036), non-verbal ability (r=-.125, p=.049) and general cognitive ability (r=-.168, p=.008). No significant associations were detected between child age of preschool attendance and cognitive development outcomes at preschool in Phase 1. Changing preschools was specifically related to better verbal ability outcome at school entry (r=.136, p=.020) (see Appendix XI).

One way ANOVAs with paternal education, maternal education, family income, family structure, main carer before preschool entry as the between-subjects variable were conducted for children's cognitive development outcomes at Phase 1. There was only a significant effect of family income on school readiness at preschool

(Phase 1) (*F* (3, 292) = 3.067, *p*=.028). Furthermore, family income as reported by parents at school entry (Phase 2) showed a significant effect on non-verbal ability (*F* (2, 265) = 3.826, *P*=.023) and general cognitive ability (*F* (2, 264) =5.328, *p*=.005) at school entry (Phase 2). A paternal education effect was detected for school readiness (Phase 1) (*F* (3, 284) = 3.738, *p*= .012), and verbal ability (*F* (3, 258) =6.154, *p*<.001), non-verbal ability (*F* (3, 258) = 3.660, *p*=.013) and general cognitive ability (*F*= (3, 257) = 6.301, *p*<.001) at school entry (Phase 2). A maternal education effect was detected for verbal ability (*F* (3, 257) =5.603, *p*=.001) and general cognitive ability (*F* (3, 256) = 3.184, *p*= .024).

Home activities

Among four aspects of home activities reported by parents (Phase 1), two were significantly and positively associated with better school readiness at preschool: family activities (*r*=.124, *p*=.040) and peer social activities (*r*=.152, *p*=.012). Three of them were significantly and positively associated with children's better general cognitive ability (Phase 1): learning activities (*r*=-.136, *p*=.025), family activities (*r*=.142, *p*=.019) and peer social activities (*r*=.135, *p*=.025).

Among all aspects of home activities at both Phase 1 and 2, family activities at Phase 1 (*r*=.127, *p*=.045) was only just significantly and positively associated with better verbal ability at school entry (Phase 2). Regularity (*r*=.132, *p*=.036) (Phase 1) was significantly and positively associated with better non-verbal ability at school entry (Phase 2). Only family activities at Phase 1 was significantly and positively associated with better general cognitive ability at school entry (Phase 2) (*r*=.159, *p*=.012) suggesting that children who engaged family activities more often were likely on average to have better cognitive ability at school entry (see Appendix XI).

Preschool centre characteristics

There is a weak but significant association between group size in classroom and children's cognitive development outcomes at preschool, one year before school entry (Phase 1) and at school entry (Phase 2). Teachers' qualification, as well as preschool quality as measured by the ECERS-R and ECERS-E, were both significantly and positively associated with cognitive outcomes at preschool (Phase 1) and at school entry (Phase 2) meaning that children with better educated preschool teachers, or from higher quality preschool centres were likely on average to have better cognitive outcomes at preschool and school entry (see Appendix XI).

Results from one way ANOVAs showed that there was significant Staff: child ratio effect on school readiness at preschool (F (2, 293) =4.022, p= .019) and general cognitive ability at school entry (Phase 2) (F (2, 264) =3.288, p= .039). A teachers' teaching experience effect was detected for school readiness (F (3, 292) =5.478, p=.001), general cognitive ability (F (3, 289) =4.187, p=.006) at preschool, as well as children's verbal ability (F (3, 264) =4.404, p=.005), and general cognitive ability (F (3, 263) =3.911, p=.009). A teachers' qualification effect was detected for school readiness (F (3, 292) =14.095, P<.001), general cognitive ability (F (3, 289) =10.769, p<.001) at preschool, and children's verbal ability (F (3, 264) =8.347, p<.001), non-verbal ability (F (3, 264) =3.984, p=.008), general cognitive ability (F (3, 263) =7.612, p<.001) at school entry. A staff: child ratio effect was also detected for school readiness at preschool (F (2,293) =4.022, p=.019) and for general cognitive ability at school entry (F (2, 264) =3.288, p=.039).

4.2.2 Multivariate Analyses

Multilevel modelling (MLM) (Goldstein, 2003) with restricted maximum likelihood (*REML*) estimation was used to construct hierarchical two-level models (child nested within preschool) for children's cognitive outcomes accounting for selected child, family characteristics and home activities. This section reports the results for cognitive outcomes in terms of school readiness, general cognitive ability at preschool at Phase 1 and the verbal ability, non-verbal ability and general cognitive ability at school entry at Phase 2 following three steps in multilevel modelling: null model, child level model and preschool level model. For cognitive outcomes at school entry, progress models were built after treating general cognitive ability at preschool as a predictor variable in the model.

School readiness at preschool, measured one year before school entry (Phase 1)

1. Null Model

In the null model, not controlling for any predictor variables and treating 19 preschool centres as random slopes/effects allowed to differentiate effects between children and preschools on school readiness. There was statistical significance on school readiness of preschool variations. The preschool level intra-correlation coefficient *(ICC)* was 21.86%, suggesting that around twenty percent of the variances in school readiness could be explained by the preschool level differences and the remaining variance was explained by child individual level differences. The Akaike Information Criterion (AIC) was 799.70 for the null model (see Table 4.14).

Table 4.14Null model for School Readiness at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	.76***	.06	78.14%
School level residual	.21*	.08	21.86%
AIC	799.70		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; *p<.05, **p<.01, ***p<.001

2. Child Level Models

Child, parent and family background characteristics, as well as the home activities were all considered as child level variables in this study. At this stage, predictor variables were chosen if they showed a significant association (or approaching significance) with school readiness outcome in previous correlation analyses, or based on the one way ANOVAs for categorical variables with significant between-subject effects. These predictor variables are child gender, family income, paternal education, family activities, peer social activities. The strategy was to enter these potential predictor variables in the model both individually and simultaneously as explanatory variables, and only keep statistically significant variables in the model or if the model was improved significantly after adding in the new variable.

Child gender

After adding child gender into the model, the Akaike Information Criterion *(AIC)* was 784.14 for the model, with a significant chi-square test ($\chi 2$ = 8.11, *df*=1, p<.001) showing that after adding in gender, the model improved significantly over the null model. Being a girl was significantly and positively associated with better school readiness (see Table 4.15).

Home activities

Aspects of home activities such as family activities and peer social activities were significantly associated with school readiness, thus they were considered as predictor variables on school readiness in the model.

Family activities and peer social activities

After adding in family activities and peer social activities as predictor variables into the model, the school level intra-class correlation coefficient *(ICC)* reduced a little (ΔICC=.48%) from the null model. The Akaike Information Criterion *(AIC)* was 800.30, suggesting the model was not improve the model significantly over the null model. Table 4.15 presents the estimates of predictor variables, peer social activities was significantly and positively associated with the school readiness, while family activities was not significant anymore. Therefore, family activities was not treated as a predictor variable in the model.

Gender and home activity-peer social activities

Since child gender and the peer social activities were both significantly associated with school readiness when tested separately as predictor variables in the model, they were added into the model simultaneously. After adding these two variables, there was change in child level intra-class correlation coefficient *(ICC)* over the null model (ΔICC=.67%). The Akaike Information Criterion *(AIC)* was 787.32 for the model, with a significant chi-square test (χ^2=12.38, df=2, p<.001) suggesting that the model was improved significantly over the null model. Being a girl and involving playing activities with friends more often at home were both associated with better school readiness at preschool (Phase 1) (see Table 4.15).

3. Preschool Level Models

Children were nested within preschools and the next stage of analysis tested the effects of preschool characteristics such as group size, staff: child ratio, level of teachers' qualification, and the preschool quality measured by the ECERS-R and ECERS-E as explanatory variables for school readiness, after controlling for child gender and home activities.

Teachers' qualification/educational level

After adding in teachers' qualification as a preschool level variable into the model, the preschool level intra-class correlation coefficient (*ICC*) was 77.47%, with a reduction (ΔICC=7.98%) over the individual level model showing that teachers qualification alone explained almost 8% of the variation in the model. The Akaike Information Criterion (AIC) was 783.11, with a significant chi-square test ($\chi 2$ =4.21, df=1, p=.04) indicating that the model was improved significantly. The presence of a preschool teacher with education background above high school was significantly associated with better children's school readiness at preschool than teachers with secondary or high school level background (see Table 4.16).

ECERS-R

After adding in preschool quality based on ECERS-R as a preschool level variable into the model, the school level intra-class correlation coefficient *(ICC)* reduced to 13.69%, with a reduction (ΔICC=8.84%) over the individual level model showing that preschool quality based on ECERS-R alone explained almost 9% of the variation in school readiness . The Akaike Information Criterion (AIC) was 781.04, with a significant chi-square test ($\chi 2$ =6.28, df=1, p=.01) indicating that the model was improved significantly over the individual level model. Preschool quality (ECERS-R) was significantly and positively associated with school readiness (see Table 4.16).

<u>*ECERS-E*</u>

After adding in preschool quality based on ECERS-E into the model, the school level intra-class correlation coefficient (*ICC*) reduced to 11.90%, with a reduction (*ΔICC*=10.63%) over the individual level model showing that preschool quality based on ECERS-R alone explained 11% of the variation in school readiness in the model. The Akaike Information Criterion (AIC) was 779.05, with a significant chi-square test (χ^2=8.27, *df*=1, *p*=.004) indicated that the model was improved significantly over the individual level model (see Table 4.16).

ECERS-R seven subscales were also tested separately instead of ECERS-R overall score as predictor variables in school readiness. They were all significantly and positively associated with school readiness, however, most of their estimates were less powerful than the ECERS-R overall score except the subscale-Parents and Staff-, therefore, it was decided to use the overall score as predictor in the model. The same situation applied to ECERS-E scale (see Appendix XII).

The multilevel models for children's school readiness preschool (one year before school entry, Phase 1) show the following:

There is significant preschool level effect explaining 22% of the variance in the null model without controlling for any predictors. Child's gender and peer social activities together explained 1% of the variances in children's general cognitive ability at preschool. Teachers' qualifications alone could explain 8% of the variance, separately preschool quality measured by ECERS-R and ECERS-E could explain 11% and 9% of the variation respectively.

Conclusions

Girls were likely on average to gain higher school readiness scores than boys at preschool. The home activity peer social activities was related to school readiness at preschool: children who had more playing activities with friends either at home or elsewhere were likely on average to gain higher school readiness scores that children who engaged less often in play with peers.

After taking child gender, peer social activities and the age of starting preschool into account, children who were taught by better educated preschool teachers were likely on average to gain higher school readiness scores. Children who attended preschool settings with higher ECERS-R and ECERS-E scores were likely on average to gain higher school readiness scores that children from lower quality preschool settings. Higher teachers' qualifications were likely in preschool settings gaining higher ECERS-R and ECERS-E scores, which suggested that better qualified teachers can provide a better quality environment as measured by the ECERS-R and ECERS-E.

Table 4.15 Child Level Model for School Readiness at Preschool

				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Gender				.73 (.06)	77.66%***	.21 (.08)	22.34%*	791.69	8.11
Intercept	-.21	.13	-1.61						
Girl	.33***	.10	3.29						
Home activities				.74 (.06)	78.62%***	.20 (.08)	21.38%*	800.30	.60
Intercept	-.28	.12	-.24						
Family activities	.05	.06	.91						
Peer social activities	.14*	.05	2.56						
Gender & home activities				.71 (.06)	77.47%***	.21 (.08)	22.53%*	787.32	12.38
Intercept	-.21+	.13	-1.66						
Girl	.36***	.10	3.58						
Peer social activities	.15**	.05	2.86						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Table 4.16 Preschool Level Models for School Readiness at Preschool

				Child level residual		Preschool level residual			
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*	*AIC*	*ΔAIC*
Model a				.72 (.06)	85.45%***	.12 (.06)	14.55%*	783.11	4.21
Intercept	-.09	.15	-.59						
Girl VS Boy	.36***	.10	3.56						
Peer social activities	.15**	.05	2.86						
Teachers qualification	.44**	.15	2.83						
Model b				.71 (.06)	86.31%***	.11 (.05)	13.69%*	781.04	6.28
Intercept	-.15	.11	-1.40						
Girl VS Boy	.34**	.10	3.44						
Peer social activities	.14*	.05	2.60						
ECERS-R	.33**	.10	3.41						
Model c				.71 (.06)	88.09%***	.10 (.05)	11.90%*	779.05	8.27
Intercept	-.15	.10	-1.50						
Girl VS Boy	.35***	.10	3.49						
Peer social activities	.14**	.05	2.75						
ECERS-E	.36***	.10	3.90						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.00;

General cognitive ability at preschool, measured one year before school entry (Phase 1)

1. Null model

In the null model, without controlling for any predictor variables, the preschool level intra-class correlation coefficient *(ICC)* was 18.96% and it was statistically significant. This suggested that preschool-level differences explained almost a fifth of the variation in general cognitive ability at preschool. The Akaike information criterion (AIC) was 813.02 for the null model (see Table 4.17).

Table 4.17 Null Model for General Cognitive Ability at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	.80***	.07	81.04%
School level residual	.19*	.08	18.96%
AIC	813.02		

Note: ICC=Intra-class correlation coefficient; AIC= The Akaike Information Criterion; +p<.10, *p<.05, **p<.01, ***p<.001

2. Child level Models

Child and family characteristics that were significantly associated with general cognitive ability (or approaching significance) in correlation analyses, or while there were significant between-subject effects detected from one way ANOVAs for categorical variables, were tested as explanatory variables in the model. These variables are child gender, family income, paternal education, home learning activities, family activities and peer social activities.

Child gender

After adding child's gender into the null model, the child level intra-class correlation coefficient (ICC) with general cognitive ability was 80.96%. The Akaike information criterion *(AIC)* was 811.66 for the model, with a non-significant Chi-Square test (χ^2 =1.36, *df*=1, p=.24), showing that the model was not improved significantly from the null model. Being a girl was only just significantly and positively associated with better general cognitive abilities (see Table 4.18).

<u>Home activities</u>

Aspects of home activities-learning activities, family activities and peer social activities were all significantly associated with general cognitive ability, thus they were added in the model as predictor variables.

Learning activities, family activities and peer social activities (Phase 1)

After adding these three variables into the model, the school level intra-class correlation coefficient (*ICC*) reduced slightly (*ΔICC*=.78%) from the null model. The Akaike information criterion (*AIC*) was 813.63 for the model, but it was not improved from the null model (*ΔAIC*=-.60%). Peer social activities were still significantly associated with general cognitive ability, while learning activities and the family activities were both no longer significant. Therefore, only peer social activities as a predictor variable was left in the model (see Table 4.18).

<u>Child gender and home activity-peer social activities (Phase 1)</u>

Since child gender and the peer social activities were both significantly associated with the general cognitive ability in the model while they were tested separately as predictor variable, they were added into model together as predictor variables. After adding these two variables together in the model, the child level intra-class correlation coefficient (*ICC*) reduced slightly from the null model (*ΔICC*=1.12%) suggesting that these two variables together explained 1% of the variation. The Akaike information criterion (*AIC*) was 808.41 for the model, with a non-significant chi-square test (χ^2=4.61, *df*=2, *p*=.10), suggesting that the model was not improved significantly. Being a girl and being involved peer social activities more frequently were both significantly and positively associated with better general cognitive ability at preschool (one year before school entry) (see Table 4.18).

3. Preschool Level Models

Preschool level variables which were significantly related to children's general cognitive ability at preschool (Phase 1), or while there were significant between-subject effects detected from one way ANOVAs for categorical variables, were entered into model as explanatory variables.

Teachers' qualification/education level

After adding in teachers' qualification as a preschool level variable in the model, the school level intra-class correlation coefficient (ICC) was 14.29%, with a reduction from the individual level model (ΔICC=5.79%) suggesting that the variable alone explained almost 8% of the variation in the model. The Akaike information criterion (AIC) was 803.93, with a significant chi-square test (χ^2=4.50, *df*=1, *p*=.03), indicating that the model was improved significantly over the individual level model. Teacher qualifications of high school level or below high school level education background were significantly and negatively associated with better children's general cognitive ability at preschool (see Table 4.19).

ECERS-R

After adding in preschool quality based on ECERS-R as a preschool level variable in the model, the school level intra-class correlation coefficient (*ICC*) was 12.66%, with a reduction from the individual level model (ΔICC=7.42%) suggesting that the variable alone explained 7% of the variation in the model. The Akaike information criterion (AIC) was 803.68, with a significant chi-square test (χ^2=4.72, *df*=1, *p*=.03) indicating that the model was improved significantly over the individual level model. After controlling for child gender and peer social activities, higher ECERS-R scores was significantly and positively associated with better children's general cognitive ability at preschool (Phase 1) (see Table 4.19).

ECERS-E

After adding in preschool quality based on ECERS-E as a preschool level variable in the model, the school level intra-class correlation coefficient (ICC) was 13.52%, with a reduction from the individual level model (ΔICC=6.56%) suggesting that the variable alone explained almost 7% of the variation in the model. The Akaike information criterion (AIC) was 804.47, with a marginally significant chi-square test (χ^2=3.94, *df*=1, *p*<.05) indicating that the model was improved significantly over the individual level model. After controlling for child gender and peer social activities, higher ECERS-E score was significantly and positively associated with better children's general cognitive ability (see Table 4.19). Again, ECERS-R seven subscales were also tested separately instead of ECERS-R overall score as predictor variables in multilevel models and they were all significantly and positively associated with better general cognitive ability. However, most of the estimates were less powerful than the ECERS-R overall score except the subscale-Parent and Staff-therefore it was decided to use the overall score as predictor variable in the model. The same situation applied to the ECERS-E (see Appendix XII). As discussed earlier in the school readiness outcome section, teachers' qualifications and preschool quality were high related to each other and therefore, these two variables were kept in separate models.

The multilevel models for children's general cognitive development at preschool (Phase 1) show the following:

There are significant preschool level differences that can explain 18.96% of the variance in null model without controlling for any predictors. Child's gender and peer social activities together explained 1% of the variances in children's general cognitive ability at preschool. Teachers' qualifications alone could explain 7% of the variance, separately preschool quality measured by ECERS-R and ECERS-E could explain 7% of the variance in the model as well.

Conclusions

Girls were likely on average to gain higher Bracken scores than boys. Aspect of home activities-peer social activities- were significantly associated with cognitive development: children who were involved more social activities with friends were likely to gain higher Bracken scores than children who took part in peer social activities less often. After taking child's gender and peer social activities into account, teacher qualification was significantly associated with children's general cognitive ability at preschool. Children who were taught by preschool teachers with high school level background or better were likely to gain higher Bracken scores than those who were taught by teachers with lower levels of education. Children experienced higher quality preschools based on ECERS-R or ECERS-E assessment were more likely to gain higher Bracken scores than those who experienced lower quality preschool settings.

Table 4.18 Child Level Model for General Cognitive Ability at Preschool

				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Gender as predictor variable				.79 (.07)	80.96%***	.19 (.08)	19.04%*	811.66	1.36
Intercept	-.11	.12	-.93						
Girl	.21*	.11	2.01						
Home activities as predictor variable				.78 (.07)	81.82%***	.17 (.08)	18.18%*	813.63	-.51
Intercept	-.004	.11	-.04						
Learning activities	-.08	.06	-1.46						
Family activities	.09	.06	1.60						
Peer social activities	.13*	.06	2.37						
Gender & home activities as predictors				.77 (.07)	79.92%***	.19 (.08)	20.08%*	808.41	4.61
Intercept	-.12	.13	-.96						
Girl	.23*	.10	2.25						
Peer social activities	.15**	.05	2.66						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Table 4.19 Preschool Level Models for General Cognitive Ability at Preschool

				Child level residual		Preschool level residual			
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*	*AIC*	*ΔAIC*
Model a				.77 (.07)	86.50%***	.12 (.06)	13.50%*	802.67	5.67
Intercept	-.37**	.14	-2.69						
Girl	.24*	.10	2.29						
Peer social activities	.14**	.05	2.62						
Teachers qualification (high school or above)	.56**	.19	2.92						
Model b				.77 (.07)	87.34%***	.11 (.06)	12.66%+	803.68	4.73
Intercept	-.07	.11	-.66						
Girl	.22*	.10	2.11						
Peer social activities	.13*	.05	2.35						
ECERS-R	.29**	.10	2.99						
Model c				.77 (.07)	86.48%***	.12 (.06)	13.52%+	804.47	3.94
Intercept	-.08	.11	-.71						
Girl	.22*	.10	2.17						
Peer social activities	.14*	.05	2.52						
ECERS-E	.28**	.10	2.76						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001.

Verbal ability outcomes at school entry (Phase 2)

1. Null Model

In the null model, without controlling for any predictive variables on verbal comprehension, the preschool level intra-class correlation coefficient (ICC) was 7.75% indicating that there were preschool level differences in verbal comprehension between children that could explain almost 8% of variance, and this was approaching statistical significance (see Table 4.20).

Table 4.20 Null Model for Verbal Ability at School Entry

Variance	B	SE	ICC
Child level residual	.91***	.08	92.25%
School level residual	$.08^{+}$	.04	7.75%
AIC	840.54		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; ^{+}p<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child level Models

Child and family characteristics that were significantly associated with verbal ability (or approaching significance) in correlation analyses, or while there were significant between-subject effects detected from one way ANOVAs for categorical variables, were tested as explanatory variables in the model.

Father's educational background

After adding father's educational background into null model as the only explanatory variable, the preschool level intra-class correlation coefficient (*ICC*) was 5.21%, with a drop from the null model (*ΔICC*=2.54%), which suggested that father's educational background explained almost 3% of the variation in verbal ability. The drop of preschool level variance suggested that there were also preschool level difference in paternal education, although it was treated as child level variable in the model. However, considering the sample size of preschools (n=19) and number of children clustered in each centre (range 7 to 26) (see Appendix I) were relatively small, the predictor variable-paternal education- was not tested as preschool level variable but rather as child level variable. The same situation applied to all multivariate analyses in this study. The Akaike's Information Criterion (*AIC*) was 831.47, with a significant chi-square test (χ^2 =9.08, *df*=1, *p*=.003), indicating that the model was improved significantly over the null model. Father's educational background was positively and significantly associated with the better verbal comprehension abilities (see Table 4.21).

Mother's educational background

After adding mother's educational background into the model as an explanatory variable, the preschool level intra-class correlation coefficient (*ICC*) was 7.36%. The Akaike's Information Criterion (*AIC*) was 836.74, with marginally a significant chi-square test (χ^2=3.81, *df*=1, *p*=.05) indicating the model was improved from the null model. Mother's education was positively and approaching significance with better verbal comprehension outcomes (see Table 4.21).

Changing preschools (stability)

After adding in changing preschools as the only explanatory variable, the child level intra-class correlation coefficient (*ICC*) was 92.21%, with a slightly drop from the null model. The Akaike's Information Criterion (*AIC*) was 836.19 for the model, with a significant chi-square test (χ^2=4.37, *df*=1, *p*=.04), indicating that the model was improved significantly from the null model. Changing preschools was positively and significantly associated with better verbal comprehension ability (see Table 4.21).

<u>*Home activities*</u>

Family activities at Phase 1

After adding in family activities as predictor variable, the school level intra-class correlation coefficient (*ICC*) reduced a little (*ΔICC*=.06%). The Akaike's Information Criterion (*AIC*) was 843.09 for the model, and it was not improved from null model at all (*ΔAIC*=-2.54). Table 4.21 presents the estimates of family activities on verbal comprehension and it was not significant.

Other characteristics such as age of starting preschool, family income as well as home activities such as go shopping and amount of books were all tested individually in the model and they did not show significant associations with verbal comprehension. Thus only father's educational background, mother's educational background and changing preschools were added into model simultaneously as explanatory variables in verbal comprehension.

<u>*Parental educational background and changing preschools*</u>

After adding parental education and changing preschools into the model, the preschool level intra-class correlation coefficient (*ICC*) was 5.62%, with a reduction (*ΔICC*=2.13%) from the null model indicating that three variables together could contribute to 2% of variances in verbal comprehension. The Akaike's Information Criterion (*AIC*) was 827.60 for the model, with a significant chi-square test (χ^2=12.95, *df*=3, p=.005) indicating that the model was improved significantly from the null model. Table 4.21presents the estimates of predictor variables: father's educational background (equal to high school or above) and changing preschools were both significantly associated with higher verbal ability scores, while mother's educational background was not significant any more, thus it was not kept in the model.

Father's educational background and changing preschools

After only adding father's educational background and changing preschool into the model, the preschool intra-class correlation coefficient (*ICC*) was 5.43%, with a drop from the null model indicating these two variables together could explain around 2 % of the variances. The Akaike's Information Criterion (*AIC*) was 826.62, with a significant chi-square test (χ^2= 13.92, *df*=2, p<.001), indicating that the model was improved significantly from the null model. Table 4.21 presents the estimates of predictor variables, of which were both significantly and positively associated with better verbal ability at school entry. Thus these variables were kept in the model.

3. Preschool Level Model

Preschool characteristics such as group size, teachers' qualification, and preschool quality were tested as explanatory variables in the model because they were significantly associated with children's verbal comprehension in correlation analyses. Separately, teachers' qualification and preschool quality measured by ECERS-R and ECERS-E were significantly and positively associated with verbal comprehension.

Teachers' qualification/education level

After adding teachers' qualification into the model, the preschool level intra-class correlation coefficient (*ICC*) was 2.36%, with a reduction (ΔICC=3.07%) from the individual level model indicating that teachers' qualification alone explained 3% of the variance in verbal comprehension. The Akaike's Information Criterion (*AIC*) was

821.01, with a significant chi-square test (χ^2= 5.62, *df*=1, p=.02), indicating that the model was improved significantly over the individual level model. After controlling for paternal and preschool stability, teachers' qualification (equals to secondary school or below) was negatively and significantly associated with better verbal comprehension ability at school entry (see Table 4.22).

ECERS-R

After adding preschool quality, measured by the *ECERS-R*, into the model, the preschool level intra-class correlation coefficient (*ICC*) dropped (*ΔICC*=3.22%) from the individual level model, indicating it explained 3% of the variance in verbal comprehension. The Akaike's Information Criterion (*AIC*) was 823.51, with a non-significant chi-square test (χ^2=3.12, *df*=1, *p*=.08) indicating that the model was improved but not significantly over the individual level model. Furthermore, when compared to the null model, with a significant chi-square test (χ^2=17.03, *df*=3, *p*<.001), indicating that the model was improved significantly with paternal education, changing preschools (preschool stability) and teachers' qualification as explanatory variables in verbal comprehension. After controlling for paternal education and preschool stability, preschool quality (ECERS-R) was still positively and significantly associated with better verbal ability at school entry (see Table 4.22).

ECERS-E

After adding preschool quality based on ECERS-E into model, the preschool level intra-class correlation coefficient (*ICC*) was 2.04%, with a reduction (*ΔICC*=3.39%) indicating that preschool quality (based on ECERS-E) could explain 3% of the variances in verbal comprehension. The Akaike's Information Criterion (*AIC*) was 822.66 for the model, with marginally a significant chi-square test (χ^2=3.96, *df*=1, *p*=.05), indicating that the model was only just improved significantly. Furthermore, when compared to the null model, there was a significant chi-Square test (χ^2=17.88, *df*=3, *p*<.001), indicating that the model was improved significantly by treating father's educational background, changing preschools and preschool quality (based on ECERS-E) as explanatory variables (see Table 4.22). Again, each ECERS-R and ECERS-E subscale was added as preschool predictor variable instead of the overall score in the model, and they were all significant in the model (see Appendix XII).

Table 4.21 Child Level Model for Verbal Ability at School Entry

				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Paternal education				.89 (.08)	94.79%***	.05 (.04)	5.21%	831.47	9.08
Intercept	.32*	.13	2.41						
Secondary school or below	-.45**	.14	-3.17						
Maternal education				.90 (.08)	92.64%***	.07 (.04)	7.36%$^{+}$	836.74	3.81
Intercept	.26	.17	1.55						
secondary school or below	-.35^{+}	.18	-1.96						
Changing preschools				.90(.08)	92.21%***	.08(.04)	7.79%$^{+}$	836.19	4.37
Intercept	.17	.12	1.45						
Not Change centre	-.31*	.12	-2.49						
Home activities (Phase 1)				.92 (.08)	92.81%***	.07 (.04)	7.19%$^{+}$	843.09	-2.54
Intercept	-.02	.08	-.28						
Family activities	.06	.06	1.02						

				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Parental education & changing centres				.87 (.07)	94.38%***	.05 (.03)	5.62%	827.60	12.95
Intercept	.57***	.17	3.28						
Father(secondary school or below)	-.40*	.16	-2.58						
Mother (secondary school or below)	-.12	.19	-.62						
Not Changing preschools	-.31*	.12	-2.49						
Paternal education & changing centres				.87 (.07)	94.57%***	.05 (.03)	5.43%	826.62	13.92
Intercept	.52***	.15	3.55						
Secondary school or below	-.45**	.14	-3.24						
Not change centres	-.32*	.12	-2.59						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Table 4.22 Preschool Level Models for Verbal Ability at School Entry (Phase 2)

				Child level residual		Preschool residual			
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*	*AIC*	*ΔAIC*
Model a				.87 (.07)	97.64%***	.02 (.02)	2.36%	821.01	5.61
Intercept	.71***	.15	4.79						
Paternal education (secondary and below)	-.38**	.14	-2.70						
Not change centres	-.30*	.12	-2.51						
TQ secondary school or below	-.40**	.14	-2.83						
Model b				.87 (.07)	97.79%***	.02 (.03)	2.21%	823.51	3.12
Intercept	.50***	.14	3.63						
Paternal education (secondary or below)	-.41**	.14	-2.94						
Not change centres	-.31*	.12	-2.55						
ECERS-R	.19**	.07	2.76						
Model c				.87 (.07)	97.96%***	.01(.02)	2.04%	822.66	3.96
Intercept	.48***	.14	3.49						
Paternal education (secondary or below)	-.40**	.14	-2.81						
Not change centres	-.30*	.12	-2.45						
ECERS-E	.20**	.07	2.87						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

4. Progress Models

Progress models were built for verbal ability at school entry (Phase 2) with children's school readiness or general cognitive ability at preschool, measured one year before school entry (Phase 1) as child level explanatory variables, after accounting for selected child- and preschool-level variables.

After adding in children's general cognitive ability at preschool in Phase 1 as a predictor variable in the model, the school level intra-class correlation coefficient (*ICC*) reduced to .13%, with a reduction (ΔICC=1.08%) over the preschool level model (with ECERS-R as predictor variable) suggesting that general cognitive ability in Phase 1 could explain 1% of the variance. The Akaike's Information Criterion (*AIC*) was 791.25, with a significant chi-square test (χ^2 =32.254, df=1, p<.001) suggesting that the model was improved significantly over the preschool level model. General cognitive ability in Phase 1 at preschool was significantly and positively associated with better verbal ability at school entry in Phase 2, after taking fathers' education, preschool stability and preschool quality into consideration. However, in the model, preschool quality (based on ECERS-R) was not significant anymore while fathers' education and preschool stability were still both significant in the model (see Table 4.23). Progress model with school readiness outcome as predictor variable showed a similar pattern and the model detail was presented in Appendix XIII.

The multilevel models for children's verbal comprehension outcomes at school entry in Phase 2 showed the following:

The preschool level differences between children could explain almost 8% of the variances for verbal comprehension abilities in the null model, and the influence was not statistically significant. Individual variables father's education and preschool stability together could explain 2% of variance in verbal comprehension at school entry. After accounting for individual level variables, teachers' qualification alone explained 2% of the variance, while separately preschool quality based on ECERS-R and ECERS-E explained around 3% of the variation in each model respectively. In progress model, predictor variable-preschool cognitive ability in Phase 1 alone explained 1% of the variation in the model after taking individual level variables and preschool level variables into account.

Conclusions

Children with fathers who had a high school or above high school level education were likely to do better in verbal comprehension scales at school entry than their counterparts whose father had a lower level education. Children who had changed preschool centres were on average doing better in the verbal ability outcomes. Children with better educated preschool teachers and from higher quality preschools on average had better verbal ability than children who were from lower quality preschools or with less educated preschool teachers.

However, after treating preschool cognitive ability in Phase 1 as predictor variable in verbal ability at school entry, preschool quality or teachers' qualification were no longer significant in the model, while paternal education, preschool stability and preschool cognitive ability were still significant. This suggests that preschool quality had an effect at the time the children are assessed in Phase 1 as the children have usually been in preschool for a substantial time by phase 1. Thereafter there are no significant additional effects of preschool quality (ECERS-R) after phase 1, and hence no effects on progress were seen from Phase 1 to 2.

Table 4.23 Progress Model for Verbal Ability at School Entry

Variable	B	SE	t
Intercept	.49***	.12	3.97
Paternal education (secondary or below)	-.38**	.13	-2.96
Not change centres	-.33**	.11	-2.94
ECERS-R	.08	.06	1.29
General cognitive ability (Phase 1)	.36***	.06	6.40
Variance	B	SE	ICC
Child level residual	.78***	.07	99.87%
School level residual	.01	.01	.13%
AIC	791.25		

Note: ICC=Intra-class correlation coefficient; AIC= The Akaike Information Criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Non-verbal ability at school entry

1. Null Model

In the null model, not controlling for any predictor variables, the preschool level intra-class correlation coefficient *(ICC)* was 6.37% indicating preschool differences between children could explain 6% of the variance in perceptual reasoning, but it was not statistically significant (see Table 4.24).

Table 4.24 Null Model for Non-verbal Ability at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	.93***	.08	93.63%
School level residual	.06	.04	6.37%
AIC	843.49		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child level Models

Father's educational background

After adding in father's education as an explanatory variable, the preschool level intra-class correlation coefficient (*ICC*) was 4.71%, with a reduction (*ΔICC*=1.66%) from the null model indicating that it explained almost 2% of the variation in perceptual reasoning. The Akaike's Information Criterion (*AIC*) was 838.10 for the model, with a significant chi-square test (χ^2 =5.39, *df*=1, *p*=.02), indicating that the model was improved significantly over the null model. Father's education background was positively and significantly associated with better perceptual reasoning ability at school entry (see Table 4.25).

Family income

After adding family income as an explanatory variable into the model, the preschool level intra-class correlation coefficient (*ICC*) reduced to 4.86%, with a reduction (*ΔICC*=1.51) from null model indicating that it explained almost 2% of variance in perceptual reasoning. The Akaike's Information Criterion (*AIC*) was 840.79, with a non-significant Chi-Square (χ^2 =2.60, *df*=1, *p*=.11), indicating that the model was improved but not statistically significant from null model. Table 4.25 presents the estimates of family income, which was significantly associated with non-verbal ability at school entry.

Home activities-Regularity (Phase 1)

After adding the home activities-regularity- in the model, the school level intra-class correlation coefficient (*ICC*) reduced a little (*ΔICC*=.15%). The Akaike's Information Criterion (*AIC*) was 843.80, and it was not improved over the null model.

The aspects of home activities-regularity- was not significant. Therefore it was not added into the model as a predictor variable later.

Other sample characteristics were also tested individually in the model and showed no significant associations with children's non-verbal ability. Thus, only family income and father's education were put into the model as explanatory variables on perceptual reasoning.

Father's education and family income

After adding these two variables into the model, the preschool level intra-class correlation coefficient (*ICC)* was 3.46%, with a reduction (*ΔICC*=2.91%) indicating that two variables together explained almost 3% of the variance in perceptual reasoning. The Akaike's Information Criterion (*AIC*) was 835.43 for the model, with a significant chi-square test (χ^2=8.06, *df*=2, *p*=.02), indicating that the model was improved significantly over the null model. Table 4.25 presents the estimates of predictor variables in individual level models.

3. Preschool Level Models

Preschool level characteristics such as group size, teachers' qualification and preschool quality were treated as explanatory variables in the model. Separately, teachers' qualification and preschool quality measured by the ECERS-R and ECERS-E both showed significant and positive associations with children's perceptual reasoning outcomes.

Teachers' qualification/education level

After adding in teachers' qualification as an explanatory variable into the model, the preschool level intra-class correlation coefficient (ICC) with perceptual reasoning ability reduced to 2.52%, a reduction (ΔICC=.95%) from the individual level model suggesting that it explained around 1% of the variance in the model. The Akaike's Information Criterion (AIC) was 834.22, with a non-significant chi-square test ($\chi2$=1.22, df=1, p=.27) indicating the model was not improved over the individual level model, by a statistically significant amount. Teachers' qualification was approaching significantly associated with non-verbal ability (see Table 4.26).

ECERS-R

After adding preschool quality measured by ECERS-R into the model, the preschool level intra-class correlation coefficient (ICC) reduced to 2.16%, with a reduction (ΔICC=1.20%) from the individual level model indicating it could explain around 1% of the variances. The Akaike's Information Criterion (AIC) was 835.67 and the model was not improved. Preschool quality (measured by the ECERS-R) was approaching significantly associated with non-verbal ability (see Table 4.26).

ECERS-E

Separately, after adding preschool quality measured by the ECERS-E into the baseline model, the preschool level intra-class correlation coefficient (ICC) reduced (ΔICC=1.57%) from the individual level model indicating it could explain almost 2% of the variances. The Akaike's Information Criterion (AIC) was 835.19, and the model was not improved significantly. Table 4.26 presents the estimates of preschool quality (measured by the ECERS-E) and it was only just significantly and positively associated with better perceptual reasoning ability, after controlling for family income and paternal education in the model. Again, each ECERS-R and ECERS-E subscale was tested as predictor variable instead of the overall score in the model in non-verbal ability in Phase 2 (see Appendix XI).

Table 4.25 Child Level Model for Non-verbal Ability at School Entry

				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Paternal education				.92 (.08)	95.29%***	.05 (.03)	4.71%	838.10	5.39
Intercept	.28*	.13	2.19						
secondary school or below	-.37**	.13	-2.74						
Family income				.92 (.08)	95.14%***	05 (.03)	4.86%	840.79	2.99
Intercept	-.12	.09	-1.31						
Above 30K	.27*	.12	2.25						
Home activities				.92 (.08)	98.78%***	.06 (.04)	6.22%	843.80	-.35
Intercept	-.003	.08	-.04						
Regularity	$.11^{+}$	.06	1.81						
Paternal education & family income				0.91 (.08)	.96.54%***	0.03 (.03)	3.47%	835.43	8.06
Intercept	.39**	.13	2.96						
secondary school or less	-.36**	.13	-2.72						
30K or less	-.26*	.12	-2.23						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Table 4.26 Preschool Level Models for Non-verbal Ability at School Entry

Variable				Child level residual		Preschool level residual		AIC	ΔAIC
	B	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Model a				.90 (.08)	97.48%***	.02 (.03)	2.52%	834.22	1.21
Intercept	.22	.16	1.34						
Family income (less than 30K)	-.23*	.12	-1.96						
Paternal education (secondary school or less)	-.31*	.14	-2.30						
Teachers qualification (high school or above)	.26^{+}	.14	1.85						
Model b				.91 (.08)	97.84%***	.02 (.03)	2.16%	835.67	-.24
Intercept	.37**	.13	2.79						
Family income (less than 30K)	-.26*	.12	-2.16						
Paternal education (secondary school or less)	-.32*	.14	-2.39						
ECERS-R	.13^{+}	.07	.19						
Model c				.91 (.08)	98.10%***	.02 (.03)	1.90%	835.19	.24
Intercept	.35**	.13	2.64						
Family income (less than 30K)	-.23*	.12	-1.96						
Father’s education (secondary school or less)	-.31*	.14	-2.30						
ECERS-E	.14*	.07	2.03						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

4. Progress Models

General cognitive ability at preschool (Phase 1) as a predictor variable

In the progress model, after adding in children's general cognitive ability at preschool in Phase 1 as a predictor variable, the school level intra-class correlation coefficient *(ICC)* reduced to .24%, with a reduction (*ΔICC*=1.66%) over the preschool level model (with ECERS-E as predictor variable) suggesting that general cognitive ability in Phase 1 could explain almost 2% of the variance in the model. The Akaike's Information Criterion *(AIC)* was 804.84, with a significant chi-square test (χ^2=30.35, *df*=1, p<.001) indicating that the model was improved significantly over the preschool level model. However, preschool quality (ECERS-E) was not significant anymore suggesting preschool quality is having no more effect after Phase 1(Table 4.27). Progress model with predictor variable-school readiness outcome in Phase 1 can be seen in Appendix XIII.

The results from multilevel models for children's perceptual reasoning in Phase 2 at school entry show the following:

Preschool level differences between the children could explain 6% of the variance in null model, and it was not statistically significant. Family income and paternal education together could explain almost 3% of the variance. Teachers' qualification alone explained 1% of the variances. Separately, preschool quality (ECERS-R or ECERS-E) explained up to 2% of the variation in the model. In the progress model, predictor variable-preschool cognitive ability could explain almost 2% of the variation in the model, after taking paternal education, family income and preschool quality or teachers' qualification into consideration.

Conclusions

Children with better educated fathers and from higher income families were likely on average to gain higher non-verbal ability scores than children with less educated fathers and from lower income families.

After accounting for family income and paternal education, children with teachers had high school or above high school level education background, or experienced high quality preschool experience (either ECERS-R or ECERS-E) were likely on average to gain better perceptual reasoning scores than children whose teachers had lower education background or experienced lower quality preschool centre.

Preschool cognitive ability was significantly and positively associated with better non-verbal ability at school entry in Phase 2, after taking paternal education, family income and preschool quality or teachers' qualification into consideration. However, neither preschool quality nor teachers' qualification was significant anymore while paternal education and family income were still both significant in the model. This indicates preschool quality has its effect up to Phase 1 but not significantly between Phase 1 and 2.

Table 4.27 Progress Model for Non-verbal Ability at School Entry

Variable	*B*	*SE*	*t*
Intercept	.33**	.12	2.73
Family income (less than 30K)	-.24*	.11	-2.17
Paternal education(secondary school or below)	-.29*	.13	-2.28
ECERS-E	.01	.06	.21
General cognitive ability (Phase 1)	.37***	.06	6.50
Variance	*B*	*SE*	*ICC*
Child level residual	.81***	.07	99.76%
School level residual	.003	.01	.24%
AIC	804.84		
ΔAIC	30.35		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; ^{+}p<.10, **p*<.05, ***p*<.01, ****p*<.001

<u>*General cognitive ability at school entry (Phase 2)*</u>

1. Null Model

In the null model, not controlling for any predictor variables and treating 19 preschool centres as random slopes/effects allowed to differentiate effects between children and preschools on general cognitive abilities. The preschool level intra-class correlation coefficient (*ICC*) with outcome was 10.24% and was statistically significant indicating that the preschool level difference between children explained 10% of the variance in general cognitive ability at school entry (see Table 4.28).

Table 4.28 Null Model for General Cognitive Ability at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	0.88***	.07	89.76%
School level residual	0.10*	.05	10.24%
AIC	833.86		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Models

Child level characteristics such as father's education, family income, ages of starting preschool, home activities were treated as explanatory variables in the model because they showed significant associations with general cognitive ability.

Fathers' education background

After adding father's educational background into the null model, the preschool level intra-class correlation coefficient (*ICC*) dropped to 7.70%, with a reduction (*ΔICC*=2.54%) from the null model suggesting that it explained almost 3% of the variance. The Akaike's Information criterion (*AIC*) was 823.46, with a significant chi-square test (χ^2=10.40, *df*=1, *p*=.001), showing the model was improved significantly over the null model. Paternal education was positively and significantly associated with better general cognitive ability at school entry (see Table 4.29).

Family income

After adding family income as an explanatory variable for general cognitive ability into the null model, the child level intra-class correlation coefficient *(ICC)* was 91.48%

and the preschool level intra-class correlation coefficient *(ICC)* was 8.52%. Similarly to the father's education case, the preschool level intra-class correlation coefficient *(ICC)* also dropped compared to the null model, suggesting that there is bigger differences between preschools rather than between children. The Akaike's Information criterion *(AIC)* was 830.65 for the model with family income as explanatory variable, with a non-significant chi-square test (χ^2=3.21, *df*=1, *p*=.07), showing that the model was improved over null model and was approaching statistical significance. Higher family income was significant and positively associated with better general cognitive ability at school entry (see Table 4.29).

Home activities

In correlation analysis, an aspect of home activities -family activities was significantly and positively associated with GAI, thus it was treated as a predictor variable in the model. After adding in family activities into the model, the preschool level intra-class correlation coefficient (*ICC)* reduced a little (*ΔICC*=.59%). The Akaike's Information criterion (*AIC*) was 834.93 for the model, and it was not improved from the null model (*ΔAIC*=-.17). Table 4.29 presents the estimates of home activities-family activities on general cognitive ability and it was not significant. Therefore, it was not kept in the model as predictor variable.

Other sample characteristics such age of attendance, shopping activities were tested individually in the model as explanatory variables for general cognitive ability and none produced significant associations. Then the variables father's education, family income and amount of books were added into the null model simultaneously as explanatory variables for general cognitive ability.

Father's education and family income

After adding father' education and family income in the model, preschool level intra-class correlation coefficient (*ICC)* dropped to 6.25%, with a reduction (*ΔICC*=3.99%) from null model indicating that two variables together explained almost 4% of the variance in general cognitive ability. The Akaike's Information criterion (AIC) was 820.08 for the model, with a significant Chi-Square test (χ^2=13.78, *df*=2, *p*=.002), indicating that the model was improved significantly from the null model. Family income and father's educational background were positively and significantly associated with better general cognitive ability in the model. Thus these two variables were kept as explanatory variables in the model (see Table 4.29).

3. Preschool Level Models

Preschool characteristics such as group size, teachers' qualification and preschool quality measured by ECERS-R and ECERS-E were tested as explanatory variables for general cognitive ability. Separately, teachers' qualification and preschool quality measured by ECERS-R and ECERS-E were significantly associated with the outcome.

Teachers' qualification

After adding in teachers' qualification as an explanatory variable into the model, the preschool level intra-class correlation coefficient *(ICC)* with perceptual reasoning ability reduced to 4.69%, with a reduction(*ΔICC*=1.56.%) from the individual level model suggesting that teachers' qualification alone explained almost 2% of the variances in the model. The Akaike's Information Criterion *(AIC)* was 817.913 for the model, with a non-significant chi-square test (χ^2=2.17, *df*=1, *p*=.14), indicating that, this model was improved but not statistically significant over the individual level model (see Table 4.30). Overall it is concluded that teachers' qualification, equal to high school or above, was associated sufficiently with better general cognitive ability at school entry to include in the final model, accounting for family income and paternal education, because of the correlation between the variables.

ECERS-R

After adding preschool quality measured by ECERS-R as an explanatory variable in the model, the preschool level intra-class correlation coefficient *(ICC)* dropped to 3.59%, with a reduction (ΔICC=2.65%) suggesting that preschool quality (based on ECERS-R) could explain almost 3% of the variance in general cognitive abilities. The Akaike's Information Criterion (*AIC*) was 818.07 for the model, with a non-significant Chi-Square test (χ^2 =2.01, *df*=1, p=.16), suggesting that the model was not improved significantly over the individual level model. Furthermore, when compared to the null model, with a significant chi-square test ($\chi 2$ =15.79, *df*=3, p=.001), indicating that the model with father's education, family income and preschool quality (ECERS-R) as explanatory variables in general cognitive ability was improved significantly over the null model. Table 4.30 presents the estimates of preschool quality (ECERS-R) which was positively and significantly associated with better general cognitive ability, accounting for family income and paternal education.

ECERS-E

Next preschool quality (measured by ECERS-E) was added to the model, and the preschool level intra-class correlation coefficient (*ICC*) dropped to 3.27%, with a reduction (ΔICC=2.97%) from the individual level model suggesting that preschool quality as measured by ECERS-E could explain for almost 3% of variance in general cognitive ability. The Akaike's Information Criterion (*AIC*) was 817.39, with a non-significant Chi-Square test (χ^2 =2.69, *df*=1, *p*=.10), suggesting that the model was not improved significantly over individual level model. Furthermore, when compared to the null model, there was a significant Chi-Square test (χ^2 =16.467, *df*=3, *p*<.001), indicating that the model with father's education, family income and preschool quality (ECERS-E) as explanatory variables in general cognitive ability was improved significantly over the null model.

Table 4.30 presents the estimated effects of preschool quality as measured by the ECERS-E, which was positively and significantly associated with better general cognitive ability, after controlling for family income and father's educational background. Again, each subscale of the ECERS-R and ECERS-E was tested as preschool level predictor variable in general cognitive ability at school entry and most of them are also significant in the model (see Appendix XI).

Table 4.29 Child Level Model for General Cognitive Ability at School Entry

				Child residual		Preschool residual		*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Paternal education				.86 (.07)	92.30%***	.07(.04)	7.70%$^{+}$	823.46	10.40
Intercept	.34*	.13	2.58						
secondary school or below	-.46***	.13	-3.45						
Family income				.88 (.07)	91.48%***	.08 (.04)	8.52%$^{+}$	830.65	3.21
Intercept	.12	.10	1.13						
Less than 30K	-.28*	.12	-2.33						
Home activities				.88 (.07)	90.35%***	.09 (.05)	9.65%*	834.93	-.17
Intercept	-.011	.090	-.13						
Family activities (Phase 1)	.09^{+}	.06	1.66						
Paternal education & family income				.85 (.07)	93.75%***	.06 (.04)	6.25%	820.08	13.78
Intercept	.47	.14	3.37						
secondary school or less	-.46***	.13	-3.46						
less than 30K	-.28*	.12	-2.34						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p* <.05,***p*<.01, ****p*<.001

Table 4.30 Preschool Level Models for General Cognitive Ability at School Entry

Variable				Child level residual		Preschool level residual		*AIC*	*ΔAIC*
	B	*SE*	*t*	*B (se)*	*ICC*	*B (se)*	*ICC*		
Model a				.85 (.07)	95.31%***	.04(.03)	4.69%	817.91	2.17
Intercept	.28+	.17	1.65						
Paternal education (secondary school or less)	-.42**	.14	-3.07						
Family income (less than 30K)	-.25*	.12	-2.10						
Teachers' qualification (high school or above)	.31+	.15	2.08						
Model b				.85 (.07)	96.41%***	.03 (.03)	3.59%	818.07	2.01
Intercept	.45***	.13	3.39						
Paternal education (secondary school or less)	-.42**	.14	-3.14						
Family income (less than 30K)	-.27*	.12	-2.31						
ECERS-R	.18*	.07	2.46						
Model c				.85 (.07)	96.73%***	.029 (.027)	3.27%	817.39	2.69
Intercept	.43***	.13	3.22						
Paternal education (secondary school or less)	-.41**	.14	-3.04						
Family income (less than 30K)	-.24*	.12	-2.07						
ECERS-E	.19**	.07	2.63						

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, **p*<.05,***p*<.01, ****p*<.001

4. Progress Models

<u>*General cognitive ability at preschool as predictor variable*</u>

In the progress model, after adding in children's general cognitive ability at in Phase 1 as a predictor variable, the school level intra-class correlation coefficient (*ICC*) reduced (ΔICC=3.03%) over the preschool level model (ECERS-R as predictor variable) suggesting that general cognitive ability in Phase 1 could explain around 3% of the variation in the model. The Akaike's Information Criterion (*AIC*) was 768.11, with a significant chi-square test (χ^2= 49.96, *df*=1, *p*<.001) suggesting the model was improved significantly over the preschool level model. However, in the model, preschool quality (ECERS-R) was not significant anymore while fathers' education and family income were both still significant in the model (See Table 4.31). Progress model with predictor variable-school readiness outcome are shown in Appendix XIII.

The multilevel models for children's general cognitive ability at school entry in Phase 2 showed the following:

There was a significant difference on children's general cognitive ability between preschools and the preschool level differences explained 10.24% of the variance in general cognitive ability at school entry. Paternal education and family income as individual level variables together explained 3% of the variances in general cognitive ability at school entry. Teachers' qualification alone explained 2% of the variances. Separately, preschool quality (ECERS-R or ECERS-E) explained up to 3% of the variances in general cognitive ability. Preschool cognitive ability in Phase 1 explained 3% of the variation in the progress model.

Conclusions

Children from lower income families and with fathers with lower education were likely to have lower general cognitive ability at school entry. Children who experienced higher quality preschools were likely to have better cognitive outcomes at school entry than children who experienced lower quality programmes. Children who were taught by preschool teachers with higher level education were likely on average to have better cognitive ability at school entry.

After taking paternal education, family income and preschool quality into consideration, children with better cognitive ability at preschool, measured one year before school entry (Phase 1), were still likely on average to have better cognitive ability at school entry in Phase 2 than children with lower preschool cognitive ability.

Table 4.31 Progress Model for General Cognitive Ability at School Entry from MLM

Variable	*B*	*SE*	*t*
Intercept	.41***	.11	3.54
Paternal education (secondary school or less)	-.39**	.12	-3.17
Family income (less than 30K)	-.25*	.11	-2.39
ECERS-E (Z score)	.04	.06	.72
General cognitive ability (Phase 1)	.44***	.06	8.33
Variance	*B*	*SE*	*ICC*
Child level residual	.71***	.06	99.44%
School level residual	.01	.02	.56%
AIC	768.11		
ΔAIC	49.28		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike Information Criterion; +*p*<.10, *p<.05, **p<.01, ***p<.001

4.3. Analysis of Social Development Outcomes

4.3.1 Preliminary Analyses

Pearson product moment correlations were used to explore the associations between child, family characteristics, home activities, preschool characteristics and children's social development outcomes at preschool (one year before school entry, Phase 1), and at school entry (Phase 2). One way ANOVAs with the categorical variable as the between-subject variable were also conducted to explore the mean difference on behaviour development outcomes between groups for categorical variables.

<u>Teacher- report social development at preschool, measured one year before school entry (Phase 1)</u>

Child, parent and family characteristics

There was a trend for being a boy to indicate the likelihood of more teacher report conduct problems($r=.105$, $p=.088$), more hyperactivity behaviours ($r=.15$, $P<.05$), and less prosocial ($r=.26$, $p<.001$) than girls at preschool. Child age approached a significant negative association with emotional symptoms ($r=-.116$, $p=.059$).

Child birth weight was also significantly and negatively associated with emotional symptoms ($r=-.170$, $p=.008$), and hyperactivity ($r=-.167$, $p=.010$) indicating that children with lower birth weight were likely on average to have more emotional symptoms and hyperactivity problems as reported by teachers than children with heavier birth weight. There was also a non-significant trend for child birth weight to be positively associated with teacher report prosocial behaviour (see Appendix XIV).

Furthermore, one way ANOVAs were conducted for social outcomes at Phase 1 with parental education, family income, family structure and main care history separately as between-subject predictor variables. No significant between group effect was detected for social outcomes at preschool, one year before school entry (Phase 1).

Home activities

Among four aspects of the home activities, only peer social activities was significantly and negatively associated with more peer problems (r=-.201, p=.002) suggesting that children involved peer social activities more often were likely to have fewer peer problems reported by preschool teachers than children who involved peer social activities less often or not at all (see Appendix XIV).

Preschool characteristics

Among all the preschool characteristics, preschool quality (either measured by the ECERS-R or the ECESR-E) was significantly associated with fewer hyperactivity problems, fewer conduct problems and more prosocial behaviours reported by preschool teachers. There were weak associations between preschool quality with teacher report behaviour outcomes-emotional symptoms and conduct problems- at preschool (See Appendix XIV).

One way ANOVAs were also conducted for social outcomes with preschool centre characteristics such as staff: child ratio, teachers teaching experiences, teachers' qualification as between-subject predictor variables. Teachers' teaching experience showed an effect for teacher report peer problems (F (3, 262) = 7.103, P<.001), and prosocial behaviour (F (3, 262) =4.902, p=.002) at preschool. Also a teachers' qualification effect was detected for teacher report peer problems (F (3, 262) =8.823, *p*<.001), and prosocial behaviour (*F* (3, 262) =4.405, *p*=.005) at preschool (one year before school entry, Phase 1).

Furthermore, there was a Staff: child ratio effect on teacher report conduct problems (*F* (2, 262) =4.120, *p*=.017), hyperactivity (*F* (2, 263) =3.586, *p*=.029), peer problems (*F* (2, 263) =5.538, *p*=.004), and prosocial behaviour (*F* (2, 263) =7.582, *p*=.001) at preschool (Phase 1). One way ANOVAs were also conducted for social outcomes with age of starting preschool (<=2.5y; 2.5y-3y; 3y-3.5y, >3.5y as categorical variables) as between-subject predictor variable and no significant effect was detected.

<u>Social development at school entry (Phase 2)</u>

Child, parent and family characteristics

Among the child characteristics, child age was significantly and negatively associated with emotional symptoms (*r*=-.172, *p*=.012) but was positively associated with behaviour regulation (r=.14, p<.01) at school entry, suggesting that younger children were likely having more emotional symptoms and better behaviour regulation as reported by parents than older children. Being an only child was significantly and positively associated with more hyperactivity problems as reported by parents (*r*=.197, *p*=.004). There were weak associations between parental educations, mother's age at child's birth with children's behaviour outcomes at school entry (see Appendix XV).

One way ANOVAs were conducted for social outcomes at Phase 2 with parental education, family income, family structure, main carer history separately as between-subject predictor variables. Family income effect was detected for parent report of conduct problems (*F* (3, 208) =2.620, *p*=.05), and behaviour self-regulation (*F* (3,

205) =3.423, *p*=.018)-at school entry (Phase 2). A main carer history was detected for emotional dysregulation (*F*= (2, 189) =4.298, *p*=.015) at school entry.

Home activities

Home activity in Phase 1- learning activities and regularity- were both significantly associated with children's conduct problems, hyperactivity, prosocial behaviour, behaviour regulation and cooperation behaviours at school entry. Peer social activities at/in Phase 1, were specifically associated with prosocial behaviour and cooperation behaviour at school entry. There were weak associations between family activities in Phase 1 with children's behaviour outcomes at school entry.

Aspects of home activities in Phase 2-individual learning activities- were significantly associated with children's behaviour outcomes at school entry: emotional symptoms, conduct problems, hyperactivity, behaviour regulation, cooperation and emotional dysregulation reported by parents at school entry. Family activities at Phase 2 were significantly associated with children's emotional symptoms, hyperactivity and emotional dysregulation at school entry. There were weak associations between parent teaching activities at Phase 2 with children's behaviour outcomes at school entry (see Appendix XV).

Preschool characteristics

There were weak associations between preschool characteristics such staff: child ratio, and classroom size, teachers' qualification and teaching experiences with behaviour outcomes as reported by parents at school entry.

Preschool centre quality, represented by the ECERS-R and ECERS-E overall scores were all not significantly associated with behaviour outcomes at school entry reported by parents. However, preschool quality, represented by specific subscales of ECERS-R and ECERS-E, were significantly associated with certain behaviour outcomes at school entry (see Appendix XV).

In summary, correlations between sample characteristics, home activities, preschool characteristics and dependant variables of social development at Phase 1 and 2, showed that certain characteristics were significantly or approaching significance in their association with social development outcomes. Thus they were considered as potential predictor variables for social development outcomes in the later multivariate analyses.

4.3.2 Multivariate Analyses

As with results for cognitive outcomes in section 2, multilevel models (Goldstein, 2003) with restricted maximum likelihood (REML) estimation was used to construct hierarchical two-level models (child nested within preschool) for children's social development outcomes (Phase 1 and 2), accounting for selected child, family characteristics, home activities, as well as the preschool characteristics.

<u>Social development outcomes at preschool (Phase 1)</u>

<u>*Emotional symptoms*</u>

1. Null Model

In the null model, without adding in any predictor variables for emotional symptoms, the preschool level intra-class correlation *(ICC)* was 11.43%, indicating that preschool level differences could explain 11% of the variance, but this was not statistically significant (p=.06) (see Table 4.32).

Table 4.32 Null Model for Teacher- report Emotional Symptoms at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	1.24***	.11	88.57%
School level residual	.16^{+}	.09	11.43%
AIC	934.92		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child level Models

In correlation analyses, child birth weight had a significant association with emotional symptoms, and the child age approached significance. Therefore, these two variables were entered into the model.

<u>*Child age*</u>

After adding individual level variable- *child age*- into the model, the school level intra-class correlation (*ICC*) decreased a little (*ΔICC*=.56) from the null model, indicating that child age explained less than 1% of the variances in emotional symptoms. The Akaike Information Criterion (*AIC*) for the model was 937.38, and the model was not improved from the null model (*ΔAIC*= -2.46). Child age was negatively and approaching significantly associated with emotional symptoms indicating that the younger children were likely on average to have more emotional symptoms as reported by preschool teachers than the older children (see Table 4.33).

<u>*Birth weight*</u>

After adding child's birth weight *(standardized birth weight)* as a predictor variable into the model, the school level intra-class correlation (*ICC*) was 11.03%, a slightly reduction (*ΔICC*=.30%) from the null model indicating that birth weight could only explain less than 1% of the variances in emotional symptoms. The Akaike Information Criterion (*AIC*) for the model with birth weight as predictor variable was 931.56, with an approaching significance chi-square test (χ^2=3.36,*df*=1, p=.07), indicating that the model was slightly but not significantly improved. Child birth weight was negatively and significantly associated with more emotional symptoms suggesting that children with lower birth weight in the sample were likely on average to have more emotional symptoms reported by preschool teachers than children with heavier birth weight (see Table 4.33).

Child age and birth weight

After adding in child birth weight and age together as predictor variables into the model, the school level intra-class correlation (*ICC*) was 10.45%, a reduction (*Δ ICC* =0.98%) from the null model indicating that these two variables together explain almost 1% of the variance . The Akaike Information Criterion (*AIC*) was 932.38, a non-significant chi-square test indicating that after adding in these two variables together as explanatory variables, the model was improved but not statistically significant. Table 4.33 presents the estimates of child's age and birth weight, both of which were significantly and negatively associated with emotional symptoms reported by preschool teachers in Phase 1. Since other sample characteristics and children's cognitive development were not significantly associated with children's emotional symptoms, they were not treated as explanatory variables in the model at this stage.

3. Preschool Level Models

Also, since no preschool level characteristics showed significant associations with child's emotional symptoms, they were not treated as explanatory variables in the model.

In summary, for children's emotional symptoms from the multilevel modelling, there was preschool level difference between children in their emotional symptoms. It could explain 11% of the variance and approached statistical significance. Child age and birth weight together could explain approximately 1% of the variation. No home activities or preschool level variables were treated as explanatory variable in the model since they were not significantly associated with emotional symptoms in the model.

Conclusions

Child age and birth weight were both significantly and negatively associated with more emotional symptoms. Neither children's cognitive development nor preschool experiences (in terms of timing, quantity and quality), were significantly associated with emotional symptoms as reported by preschool teachers.

Table 4.33 Child Level Model for Teacher- report Emotional Symptoms at Preschool

				Child level residual			Preschool level residual			AIC	ΔAIC
Variable	*B*	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Age				1.23***	.11	89.13%	.15+	.08	10.87%	937.38	-2.46
Intercept	3.47*	1.44	2.41								
Age	-.04+	.02	-1.78								
Birth weight				1.21***	.11	88.97%	.15+	.08	11.03%	931.56	3.36
Intercept	.92***	.11	8.14								
Birth weight (Z scores)	-.17*	.07	-2.44								
Age & Birth weight				1.20***	.11	89.55%	.14+	.08	10.45	932.38	2.54
Intercept	4.01**	1.44	2.79								
Age	-.04+	.02	-2.16								
Birth weight (Z scores)	-.20**	.07	-2.72								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Conduct problems

1. Null Model

In the null model, the preschool level intra-class correlation (*ICC*) was 5.96% indicating that preschool level differences could explain approximately 6% of the variances in conduct problems, which was not statistically significant (p=.21). The Akaike Information Criterion (*AIC*) for the null model was 867.49 (see Table 4.34).

Table 4.34 Null Model for Teacher- report Conduct Problems at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	1.01***	.11	94.04%
School level residual	.06	.05	5.96%
AIC	867.49		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; *p<.05, **p<.01, ***p<.001

2. Child Level Models

Among the sample characteristics, child gender was marginally associated with conduct problems in correlations analysis (r=-.105, p=.09) so it was tested as explanatory variable in the model.

Child gender

After adding child gender into the model, the school level intra-class correlation (*ICC*) reduced to 5.38%, a slight but non-significant reduction (ΔICC=.58%) from the null model indicating that child gender could explain less than 1% of the variances in conduct problems. The Akaike Information Criterion (*AIC*) was 865.77 for the model, with a non-significant chi-square test (χ^2=1.72, df=1, p=.19) indicating that the model was not improved significantly from the null model. Table 4.35 presents the estimates of child's gender on conduct problems. Although gender was not significantly associated with conduct problems, the model was improved marginally (although not statistically significant) from the null model after adding in gender as predictor variable, thus it was decided to keep it into the model.

Table 4.35 Child Level Model for Teacher- report Conduct Problems at Preschool

Variable	*B*	*SE*	*t*
Intercept	1.11***	.12	9.16
Girl	-.23	.14	-1.65
Variance	*B*	*SE*	*ICC*
Child level residual	1.00***	.11	94.62%
School level residual	.06	.05	5.38%
AIC	865.77		
ΔAIC	1.72		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; *p<.05, **p<.01, ***p<.001

3. Preschool Level Models

Staff: child ratio

After adding staff: child ratio into the model, the school level intra-class correlation *(ICC)* was 3.10 %, a reduction from the individual level model (*ΔICC*=2.28%) indicating that the staff: child ratio could explain 2% of the variances in conduct problems. The Akaike Information Criterion *(AIC)* for the model was 861.32, with a significant chi-square test (χ^2 =6.177, *df*=1, p=.01), suggesting that the model was improved significantly over the individual level model. Table 4.36 presents the estimates of predictor variables, of which being a girl was likely to have fewer conduct problems, and children in a classroom with staff: child ratio below 1:28 were likely to have more conduct problems reported by preschool teachers than children in classroom with staff: child ratio above 28:1.

For children's conduct problems from multilevel modelling, preschool differences between children could explain approximately 6% of the variation in the model, and it was not statistically significant. Child gender explained less than 1% of the variation in the model as individual level explanatory variable. The staff: child ratio explained 2% of the variation in the model as preschool level variable.

Conclusion

Girls were likely to have fewer conduct problems as reported by preschool teachers than boys. The staff: child ratio approached significance and was negatively associated with conduct problems.

Table 4.36 Preschool Level Model for Teacher- report Conduct Problems at Preschool from MLM

Variable	*B*	*SE*	*t*
Intercept	.85***	.16	5.47
Girl	-.23	.14	-1.63
staff: child ratio (below 1: 28)	.39*	.15	2.56
Variance	*B*	*SE*	*ICC*
Child level residual	1.00***	.11	96.90%
School level residual	.03	.04	3.10%
AIC	861.32		
ΔAIC	6.18		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; *p<.05, **p<.01, ***p<.001

Hyperactivity

1. Null Model

In the null model, the school level intra-class correlation (*ICC*) was 13.11% indicating that preschool level differences between children could explain 13% of the variances in hyperactivity. The preschool level influence was approaching statistically significance (p=.064). The Akaike Information Criterion (*AIC)* for the null model was 1302.41 (see Table 4.37).

Table 4.37 Null Model for Teacher- report Hyperactivity at Preschool from MLM

Variance	*B*	*SE*	*ICC*
Child level residual	4.24***	.39	86.89%
School level residual	.64^{+}	.35	13.11%
AIC	1302.41		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10; *p<.05, **p<.01, ***p<.001

2. Child Level Models

Child gender

After adding in gender as explanatory variable into the model, the school level intra-class correlation (*ICC*) reduced to 12.18%, a reduction (ΔICC=0.93) from the null model indicating that child gender could explain approximately 1% of the variance in the outcome. The Akaike Information Criterion (*AIC*) for the model was 1297.38, a significant chi-square test (χ^2=5.03, df=1, p=.02), indicating that the model was improved significantly from the null model. Being a girl was negatively and significantly associated with more hyperactivity as reported by parent at preschool.

Birth weight

After adding in child's birth weight as an explanatory variable, the preschool level intra-class correlation (*ICC)* was 12.21%, a reduction (*ΔICC*=0.90) from the null model indicating that child birth weight explained less than 1% of the variances in hyperactivity. The Akaike Information Criterion (*AIC*) was 1298.03, with a significant chi-square test ($\chi2$ =4.38, *df*=1, *p*=.04), indicating that the model was improved significantly from the null model. Table 4.38 presents the estimates of child's birth weight and it was negatively associated with child's hyperactivity.

Gender and birth weight

Since the models with child gender or birth weight as predictor variables were both improved significantly from the null model, these two variables were then added in the model simultaneously as explanatory variables in hyperactivity. The school level intra-class correlation *(ICC)* was 11.09%, a reduction (*ΔICC*=2.02) from the null model indicating that these two variables together could explain 2% of the variances on the outcome. The Akaike Information Criterion (AIC) was 1291.32, with a significant chi-square test ($\chi2$ =11.09, *df*=2, p=.003), indicating that the model was improved significantly from the null model after adding in child's gender and birth weight as explanatory variables for hyperactivity. Table 4.38 presents the estimates of child's gender and birth weight for hyperactivity. Being a girl on average resulted in less hyperactivity reported by teachers. A child with heavier birth weight was likely to show less hyperactivity than children with lower birth weight.

3. Preschool Level Models

The preschool characteristic-preschool quality (ECERS-R) had a significant association with hyperactivity in correlation analyses, but in MLM it was not significantly associated with children's hyperactivity. The preschool quality measured by the ECERS-R subscale- Interactions, the ECERS-E subscale -Literature and Science were also significantly associated with hyperactivity in univariate analyses, thus they were tested as explanatory variable in the model.

ECERS-R subscale-Interactions

After adding in the preschool quality measured by the *ECERS-R* subscale-Interaction as explanatory variable into the school level model, the school level intra-class correlation (*ICC*) was 8.60%, a reduction from the null model (*ΔICC*=2.49) indicating that it could explain 2% of the variance in hyperactivity. The Akaike Information Criterion (*AIC*) was 1288.99, with a non-significant chi-square test (χ^2 =2.33, *df*=1, *p*=.13), indicating that the model was improved but not statistically significantly over the individual level model. Table 4.39 presents the estimates of preschool quality as measured by the ECERS-R interaction, which was negatively associated with hyperactivity, and it was approaching significance.

ECERS-E subscale -Literacy

After adding the preschool quality measured by the *ECERS-E* subscale- Literacy as explanatory variable into the school level model, the school level intra-class correlation (*ICC*) was 9.42%, a reduction from the null model (*ΔICC*=1.67%) indicating that it explained almost 2% of the variance in hyperactivity. The Akaike Information Criterion (*AIC*) was 1288.39 with a non-significant chi-square test (χ^2=2.93, *df*=1, *p*=.09), indicating that the model was improved by a non-significant amount over the individual level model. Preschool quality based on the *ECERS-E* subscale-*Literature* was negatively and approaching significance associated with hyperactivity reported by preschool teachers (See Table 4.39).

ECERS-E subscale -Science

After adding in the preschool quality measured by the *ECERS-E* subscale- Science as explanatory variable into the school level model, the school level intra-class correlation (*ICC*) was 9.32%, a reduction from the null model (*ΔICC*=1.77%) indicating the model could explain less than 2% of the variance in hyperactivity. The Akaike Information Criterion (*AIC*) was 1289.25 with a non-significant chi-square test (χ^2 =2.07, *df*= 1, p=.15), suggesting that the model was improved but not to a statistically significant degree. There was a trend for preschool quality based on ECERS-E Science to be negatively related to less hyperactivity (see Table 4.39).

For child's hyperactivity at preschool from multilevel model, Preschool level differences between children explained 13% of the variance on hyperactivity but only approached statistical significance. Child's gender and birth weight as individual level explanatory variables, together explained 2% of the variation in hyperactivity. Preschool quality as measured by the ECERS-R and ECERS-E explained less than 3% of the variation in hyperactivity.

Conclusions

Girls were likely on average being less hyperactive than boys as reported by preschool teachers. Children with heavier birth weight had slightly less hyperactivity than children with lighter birth weights.

Children from higher quality classrooms based on these three subscales were likely on average to be less hyperactive reported by teachers than children from lower quality preschools.

Table 4.38 Child Level Model for Teacher- report Hyperactivity at Preschool

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Gender				4.18***	.38	87.82%	.58+	.33	12.18%	1297.38	5.03
Intercept	.29***	.27	11.01								
Girl	-.59*	.26	-2.26								
Birth weight				4.17***	.40	87.79%	.58+	.32	12.21%	1298.03	4.38
Intercept	2.62***	.22	11.91								
Birth weight	-.31+	.16	-1.84								
Gender & birth weight				4.09***	.39	88.91%	.51+	.30	11.09%	1291.32	11.09
Intercept	2.95***	.26	11.54								
Birth weight	-.34+	.17	-2.06								
Girl	-.66*	.26	-2.56								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Table 4.39 Preschool Level Models for Teacher- report Hyperactivity at Preschool

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Model a				4.10***	.39	91.40%	.39	.26	8.60%	1288.99	13.43
Intercept	2.92***	.24	11.99								
Birth weight	-.34^{+}	.17	-2.05								
Girl	-.65*	.26	-2.53								
ECERS-R Interactions	-.34^{+}	.17	-1.93								
Model b				4.08***	.389	90.58%	.42^{+}	.27	9.42%	1288.39	14.02
Intercept	2.90***	.25	11.58								
Birth weight	-.35^{+}	.17	-2.08								
Girl	-.65*	.26	-2.52								
ECERS-E Literature	-.39^{+}	.20	-1.91								
Model c				4.09***	.39	90.68%	.42^{+}	.27	9.32%	1289.25	13.16
Intercept	2.90***	.25	11.44								
Birth weight	-.35^{+}	.17	-2.08								
Girl	-.66*	.26	-2.53								
ECERS-E Science	-.37^{+}	.20	-1.87								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Peer problems

1. Null Model

In the null model, the school level intra-class correlation *(ICC)* was 24.74% indicating that there were preschool level differences in child peer problems, an effect that was statistically significant (*p*=.014). The Akaike Information Criterion (*AIC*) for the null model was 996.05 (see Table 4.40).

Table 4.40 Null Model for Teacher- report Peer Problems at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	1.46***	.13	75.26%
School level residual	.48*	.19	24.74%
AIC	996.05		

Note: ICC=Intra-class correlation coefficient; AIC= The Akaike information criterion; *p<.05, **p<.01, ***p<.001

2. Child Level Model

Family income

After adding in family income as explanatory variable on peer problems, the child level intra-class correlation coefficient (*ICC*) reduced to 74.87%, a slight reduction (ΔICC =.39) from the null model indicating that child's family income explained less than 1% of the variance in peer problems. The Akaike Information Criterion (*AIC*) was 992.44, with a marginally significant chi-square test (χ^2=3.61, *df*=1, *p*=.06), indicating that the model was slightly improved from the null mode. Family income was significantly associated with peer problems (See Table 4.41).

Home activities

After adding peer social activities in Phase 1 in the model, the preschool level intra-class correlation (*ICC)* reduced a little (*ΔICC*=.83%). The Akaike Information Criterion (*AIC*) was 986.33, with a significant chi-square test (χ^2=9.72, *df*=1, p=.001) indicating that the model was improved significantly over the null model. Table 4.41 presents the estimates of peer social activities in peer problems.

Family income and peer social activities

Since family income and peer social activities were both significant while they were tested separately as predictor variable in peer problems, they were added into model simultaneously. The school level intra-class correlation (*ICC*) reduced a little (*ΔICC*=.60%). The Akaike Information Criterion (*AIC*) was 983.76, with a significant chi-square test (χ^2=13.29, *df*=2, *p*=.001) indicating that the model was improved significantly over the null. Table 4.41 presents the estimates of these predictor variables, of which were both significant.

3. Preschool Level Model

Teachers' teaching experiences

After adding teachers' teaching experience into the model, the school level intra-class correlation (*ICC*) reduced to 22.96%, a reduction (*ΔICC*=1.11%) from the individual level model suggesting that it explained only 1% of the variation in the model. The Akaike Information Criterion (*AIC*) was 979.30, with a significant chi-square test (χ^2 =4.46, *df*=1, *p*=.03), suggesting that the model was improved significantly. Teachers' teaching experience was still relevant to children's peer problems, accounting for family income and peer social activities (see Table 4.42).

ECERS-R-Interactions

After adding preschool quality (based on ECERS-R Interaction) into the model, the school level intra-class correlation (ICC) reduced to 20.73%, a reduction (ΔICC=3.34%) from the individual level model suggesting that it explained 3.34% of the variation in the model. The Akaike Information Criterion (AIC) was 980.01, with approaching significance chi-square test (χ^2 =3.76, *df*=1, p=.05), suggesting that the model was improved over the individual level model. Preschool quality (based on ECERS-R-Interactions) was significantly and negatively related to more peer problems accounting for family income and peer social activities (see Table 4.42).

Teaching experience and preschool quality

After adding teaching experience and preschool quality (based on ECERS-R Interaction) into the model, the school level intra-class correlation (ICC) reduced to 18.01%, a reduction (ΔICC=6.06%) from the individual level model suggesting that these two variables explained 6% of the variations in the model. The Akaike Information Criterion (*AIC*) was 975.70, with a significant chi-square test (χ^2 =8.06, df=2, p=.02), suggesting that the model was improved significantly over the individual level model. Preschool quality (based on ECERS-R-Interactions) and teaching experience were both significantly related to teacher report peer problems after accounting for family income and peer social activities (See Table 4.42).

Other preschool level characteristics such as teachers' qualification, classroom size, staff: child ratio were also tested as predictor variables in the model and as they were not significant, they were therefore not kept in the final model.

For children's teacher reported peer problems at preschool from multilevel modelling,

There was preschool level difference between children in the outcome, which explained almost 25% of the variation in the null model. Family income and peer social activities together explained less than 1% of the variation in individual level model. Teachers' teaching experiences and preschool quality (ECERS-R-Interaction) explained 6% of the variation in the preschool level model.

Conclusions

Child's family income had an effect approaching significance. Children from families with annual income less than 30K were likely on average to have more peer problems as reported by preschool teachers than children from families with greater income. Child's home social activities were significantly and negatively associated with peer problems; children who experienced more playing activities with friends either at home or elsewhere, or more visiting relatives activities, were likely on average to have fewer peer problems than children who had less home organized social activity. After accounting for family income and peer social activities,

Children who were taught by preschool teachers with more than 20 years teaching experience were likely, on average, to have more peer problems reported at preschool than children who were cared by preschool teachers with less than 20 years teaching experience; children who experienced higher quality preschool centre (based on ECERS-R Interactions), were likely on average, to have fewer peer problems reported at preschool, than children who experienced lower quality preschool centres.

Table 4.41 Child Level Models for Teacher- report Peer Problems at Preschool

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Family income				1.43***	.13	74.87%	.48*	.19	25.13%	992.44	3.61
Intercept	1.74***	.20	8.66								
30K and below	.36*	.16	2.25								
Home activities				1.40***	.13	76.09%	.44*	.18	23.91%	986.33	9.72
Intercept	1.95***	.17	11.40								
Peer social activities	-.26***	.08	-3.52								
Family income & Home activities				1.38***	.13	75.93%	.44*	.18	24.07%	983.76	13.29
Intercept	1.75***	.19	9.02								
Peer social activities	-.25***	.08	-3.37								
30K and below	.32*	.16	2.05								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Table 4.42 Preschool Level Models for Teacher- report Peer Problems at Preschool

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Model a				1.37***	.12	77.04%	.41*	.17	22.96%	979.30	4.46
Intercept	2.22***	.29	7.73								
Peer social activities	-.26***	.07	-3.45								
Family income (30K and below)	.30^{+}	.15	1.96								
Teaching experience (less than 20y)	-.68*	.32	-2.15								
Model b				1.37***	.12	79.23%	.36*	.15	20.73%	980.01	3.76
Intercept	1.71***	.183	9.348								
Family income (30K and below)	.32*	.15	2.077								
Peer social activities	-.25	.07	-3.357								
ECERS-R Interaction	-.33*	.13	-2.477								
Model c				1.37***	.12	81.99%	.30*	.13	18.01%	975.70	8.06
Intercept	2.16***	.26	8.151								
Peer social activities	-.26**	.07	-2.192								
Family income (30K and below)	.30*	.15	1.969								
Teaching experience (less than 20y)	-.63*	.29	-2.192								
ECERS-R Interaction	-.32*	.13	-2.536								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Prosocial behaviour

1. Null Model

In the null model, the school level intra-class correlation (*ICC*) was 35.94%, which was statistically significant (p=.010). This suggested that there were preschool level differences that could almost explain 36% of the variance in prosocial behaviour. The Akaike Information Criterion (*AIC*) for the model was 1206.18 (see Table 4.43).

Table 4.43 Null Model for Teacher- report Prosocial Behaviour at Preschool

Variance	*B*	*SE*	*ICC*
Child level residual	2.87***	.26	64.06%
School level residual	1.61*	.62	35.94%
AIC	1206.18		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Models

Child gender

After adding in child gender as an explanatory variable, the child level intra-class correlation (*ICC*) reduced to 63.90%, a slight reduction (ΔICC=0.16) from the null model. The Akaike Information Criterion (*AIC*) was 1186.73, with a significant Chi-square test (χ^2=19.45,df=1, p<.001), indicating that it was improved significantly over the null model. Girls were likely on average to show more prosocial behaviour than boys (see Table 4.44). Although birth weight had a significant association with prosocial behaviour in correlation analyses, it was no longer significantly associated with the outcome when tested as an explanatory variable in the MLM and did not improve the model. Therefore, only child gender was kept in the model as individual level predictor variable for prosocial behaviour.

Table 4.44 Child Level Model for Teacher- report Prosocial Behaviour at Preschool

Variable	*B*	*SE*	*t*
Intercept	6.67***	.32	20.77
Girl	.89***	.22	4.11
Variance	*B*	*SE*	*ICC*
Child level residual	2.69***	.25	63.90%
School level residual	1.52*	.59	36.10%
AIC	1186.73		
ΔAIC	19.45		

Note: *ICC*=Intra-class correlation coefficient*; AIC*= The Akaike information criterion; *+p<.10, *p<.05, **p<.01, ***p<.001*

3. Preschool Level Models

<u>*ECERS-E*</u>

After adding in preschool quality (based on the ECERS-E) as an explanatory variable for prosocial behaviours, the preschool level intra-class correlation (*ICC*) was 32.41%, a reduction *(ΔICC*=3.69%) indicating that it almost explained 4% of the variance. The Akaike Information Criterion (AIC) was 1183.70 but the chi-square test only approached significance (χ^2 =3.03, *df*=1, p=.08), indicating the model was not significantly improved over the individual level model. Table 4.45 presents the estimates of preschool quality, of which was approaching significance.

<u>*ECERS-E Literature*</u>

After adding in preschool quality (based on the ECERS-E Literature) as an explanatory variablefor prosocial behaviours, the preschool level intra-class correlation (*ICC*) was 32.07%, a reduction from the baseline model *(ΔICC*=4.03%) indicating it could explain 4% of the variance. The Akaike Information Criterion (AIC) was 1183.88, with a non-significant chi-square test (χ^2 =2.85, *df*=1, p=.09), indicating the model was not significantly improved. Preschool quality (based on the ECERS-R Literature), was approaching significance in the model (See Table 4.45).

ECERS-E-Science

After adding in preschool quality (based on the ECERS-E-Science) as an explanatory variable for prosocial behaviours, the preschool level intra-class correlation (ICC) was 28.95%, a reduction from the baseline model (*ΔICC*= 7.15%) indicating it could explain 7% of the variance. The Akaike Information Criterion (AIC) was 1182.49, with a significant chi-square test (χ^2 =4.24, *df*=1, p=.04), indicating the model was improved significantly. Preschool quality (based on ECERS-E Science) and being a girl were both significantly related to teacher report prosocial behaviour at preschool. Other preschool characteristics were also tested in the model and they were not significant, therefore they were not kept in the model.

For children's teacher reported prosocial behaviours at preschool (Phase 1) from multilevel models, there were preschool level differences which explained almost 36% of the variation in the null model. Child's gender explained less than 1% of the variance and preschool quality explained less than 4% of the variations.

Conclusions

Girls were likely on average to have more prosocial behaviour as reported by preschool teachers than boys. Children from higher quality preschools were likely on average to have more prosocial behaviour as reported by teachers than children from lower quality preschool centres.

Table 4.45 Preschool Level Models for Teacher- report Prosocial Behaviour at Preschool

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Model a				2.69***	.25	67.59%	1.29*	.53	32.41%	1183.70	3.03
Intercept	6.78***	.31	22.10								
Girl	.89***	.22	4.10								
ECERS-E (Z score)	.58^{+}	.30	1.92								
Model b				2.69***	.25	67.93%	1.27*	.52	32.07%	1183.88	2.85
Intercept	6.77***	.30	22.33								
Gilr	.89***	.22	4.10								
ECERS-E-Literature (Z score)	.56^{+}	.29	1.89								
Model c				2.70***	.25	71.05%	1.10*	.47	28.95%	1182.49	4.24
Intercept	6.79***	.29	23.57								
Girl	.89***	.22	4.10								
ECERS-E-Science (Z score)	.64*	.28	2.34								

Note: ICC=Intra-class correlation coefficient; AIC= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

Social development outcomes at school entry (Phase 2)

Emotional symptoms

1. Null Model

In the null model, without adding in any predictor variables, the preschool level Intra class correlation coefficient *(ICC)* was .59% indicating that there was little preschool level difference between children in emotional symptoms (see Table 4.46).

Table 4.46 Null Model for Parent-report Emotional Symptoms at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	2.22***	.20	99.41%
School level residual	.01	.05	.59%
AIC	1090.73		

Note: *ICC*= Intra class correlation coefficient; *AIC*= The Akaike Information Criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Model

Child age

After adding child age into the model, the school level intra- class correlation coefficient *(ICC)* decreased slightly from the null model (*ΔICC*=.18). The Akaike Information Criterion (*AIC)* for the model was 1091.09, and the model was not improved from the null model (*ΔAIC*=-.29) (see Table 4.47). There was no significant association for child's age with emotional symptoms.

Home activities-Individual learning and family activities (Phase 2)

After adding individual learning and family activities (Phase 2) into the model, the preschool level intra- class correlation coefficient *(ICC)* reduced slightly (*ΔICC*=.34%). The Akaike Information Criterion (*AIC*) was 1073.34, with a significant chi-square test (χ^2 =17.39, *df*=2, *p*<.001) indicating that the model was improved significantly over the null model. They were both negatively and significantly associated with more emotional symptoms (see Table 4.47).

<u>Child age and home activities (Phase 2)</u>

After adding child's age and the home activities all in the model, the Akaike Information Criterion (AIC) was 1072.50, with a significant chi-square test (χ^2 =18.23, *df*=3, p<.001) indicating that the model was improved significantly. Table 4.47 presents the estimates of these three predictor variables, of which were all significance.

For children's emotional symptoms at school entry from multilevel modelling, there was little preschool level difference in children's emotional symptoms at school entry. Home activities explained less than 1% of the variations as individual level variable. No preschool level variables were added into model as they were neither significant nor improving the model. No progress model was built as there was not significant association between teacher report emotional symptoms at preschool and parent report emotional symptoms at school entry.

Conclusions

Children who engaged in more individual activities as well as family activities at home were likely to have fewer emotional symptoms at school entry than children who engaged in activities less often. Younger children were likely, on average, to have more emotional symptoms at school entry reported by parents than older children. Neither children's cognitive development nor preschool experiences (in terms of timing, quantity and quality) were significantly associated with emotional symptoms as reported by parent at school entry.

Table 4.47 Child Level Models for Parent- report Emotional Symptoms at School Entry

				Child residual			Preschool residual			*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Age				2.19***	.21	99.59%	0.01	.04	.41%	1091.09	-.29
Intercept	5.99*	2.35	2.55								
Age	-.06+	.03	-1.89								
Home activities (Phase 2)				2.07***	.19	99.93%	.001	.03	.07%	1073.34	17.39
Intercept	1.53***	.10	15.92								
Individual learning	-.34***	.09	-3.65								
Family activities	-.23*	.10	-2.25								
Age & home activities (Phase 2)				2.04***	.20	99.95%	.001	.02	.05%	1072.50	18.23
Intercept	6.29**	2.26	2.786								
Age	-.06*	.03	-2.094								
Individual learning	-.34***	.09	-3.729								
Family activities	-.24*	.10	-2.448								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; $^{+}p<.10$, $*p<.05$, $**p<.01$, $***p<.001$

Conduct problems

1. Null Model

In the null model, the school level intra-class correlation coefficient (*ICC)* was 9.76%, indicating that the preschool level difference between children could explain almost 10% of the variances in conduct problems, and it was not statistically significant (*p*=.108) (see Table 4.48).

Table 4.48 Null Model for Parent-report Conduct Problem at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	1.95***	.22	90.24%
School level residual	.21	.13	9.76%
AIC	1068.28		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child Level Model

Home activities

Learning activities and Regularity in Phase 1

After adding learning activities and regularity in Phase 1 as predictor variables in the model, the school level intra class correlation coefficient (*ICC*) drops to 7.17%, a (*ΔICC*=2.59%), a reduction from the null model suggesting that these two variables explained almost 3% of the variation. The Akaike Information Criterion (*AIC*) was 1056.07, with a significant chi-square test (χ^2 =12.276, *df*=2, *p*=.002) indicating that the model was improved significantly over the null model. Table 4.49 presents the estimates of predictor variables, both of which were significance.

Individual learning activities in Phase 2

After adding home activity-individual learning activities- in Phase 2 into the model, the preschool level intra- class correlation coefficient (*ICC*) reduced a little (ΔICC=1.52%). The Akaike Information Criterion (*AIC*) was 1062.81, with a significant chi-square test (χ^2 =5.47, df=1, p=.02) indicating that the model was improved significantly over the null model (See Table 4.49). Considering that adding in this variable makes the model better, individual learning activities in Phase 2 was retained as a predictor variable.

The results from the multilevel models for conduct problems at school entry showed the following: The preschool level difference between children could explain almost 10% of the variances in the outcome, and the preschool influence was not statistically significant. Home activity at preschool explained up to3% of the variation, while home activity at school entry explained up to 2% of the variation. No preschool level variables were kept in the model as they were not significantly associated with conduct problems. No progress model was built as there was not significant association between teacher report conduct problems at preschool and parent report conduct problems at school entry.

Conclusions

Child with more regularity in TV watching and sleeping time during preschool was likely to have fewer conduct problems at school entry. Children with more home learning activities during preschool and at school entry were likely to have fewer conduct problems at school entry than children who engaged less often. Children's preschool centre experiences (in terms of timing, quantity and quality) were not significantly associated with parent report conduct problems at school entry.

Table 4.49 Child Level Models for Parent- report Conduct Problems at School Entry

				Child residual			Preschool residual			*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Home activities (Phase 1)				1.87***	.22	92.83%	.14	.11	7.17%	1056.07	12.28
Intercept	1.63***	.14	11.77								
Learning activities	-.22*	.11	-2.06								
Regularity	-.28**	.09	-3.02								
Home activities (Phase 2)				1.92***	.22	97.76%	.17	.12	8.24%	1062.81	5.47
Intercept	1.63***	.14	11.62								
Individual learning activities	-.22	.15	-1.46								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion;

^{+}p<.10, *p<.05, **p<.01, ***p<.001

<u>Hyperactivity</u>

1. Null Model

In the null model, without adding in any predictor variables for hyperactivity, the preschool level intra- class correlation coefficient *(ICC*) was 1.71%, indicating that preschool level differences between children could only explain 2% of the variance in hyperactivity and the preschool level influence was not significant. The Akaike Information Criterion (*AIC*) was 1319.46 for the null model (see Table 4.50).

Table 4.50 Null Model for Parent- report Hyperactivity at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	4.76***	.44	98.29%
School level residual	.08	.17	1.71%
AIC	1319.46		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Model

Aspects of home activities-learning activities and regularity in Phase 1 and Phase 2 individual learning activities were all significantly associated (or approaching significance) with hyperactivity, therefore, they were tested as explanatory variables in the model.

<u>Home activities</u>

Learning activities and regularity in Phase 1

After adding learning activities and regularity into the model, the preschool level intra- class correlation coefficient (*ICC*) reduced a bit (*ΔICC*=.39%). The Akaike

Information Criterion (*AIC*) was 1306.07, with a significant chi-square test (χ^2=13.38, *df*=2, p=.001), indicating that the model was improved significantly over the null model. Aspects of home activities-learning activities and regularity were both negatively and significantly associated with hyperactivity behaviour (see Table 4.51).

Individual learning activities in Phase 2

After adding in individual learning activities (Phase 2) into the model, the preschool level intra- class correlation coefficient *(ICC)* reduced a little (ΔICC=.83%). The Akaike Information Criterion *(AIC)* was 1306.83, with a significant chi-square test (χ^2 =12.63,*df*=1, *p*<.001), indicating that the model was improved significantly over the null model. The individual learning activities (Phase 2) was negatively associated with parent report hyperactivity problems at school entry (see Table 4.51).

For children's hyperactivity behaviour at school entry from multilevel modelling, Preschool level differences between children explained approximately 2% of the variation in the null model. Learning activities at home measured at preschool and at school entry explained less than 1% of the variation in hyperactivity at school entry. Preschool level variables were not kept in the model as they were not significant. No progress model was built as there was not significant association between preschool teacher report hyperactivity behaviour and parent report hyperactivity at school entry.

Conclusions

Children had regular bedtime and TV watching were likely on average to show less hyperactivity at school entry than children had less regularity activity. Children who engaged in learning activities at home more often either at preschool or at school entry were likely to have less hyperactivity behaviour at school entry as reported by parents than children who engaged in less often.

Table 4.51 Child Level Models for Parent-report Hyperactivity at School Entry from MLM

Variable				Child residual			Preschool residual			*AIC*	*ΔAIC*
	B	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Home activities (Phase 1)				4.52***	.39	98.68%	.06	.14	1.32%	1306.07	13.38
Intercept	3.19***	.15	20.69								
Learning activities	-.37*	.11	-2.22								
Regularity	-.37*	.17	-2.22								
Home activities (Phase 2)				4.57***	.41	99.12%	.04	.12	.88%	1306.83	12.63
Intercept	3.19***	.16	20.10								
Individual learning	-.49***	.14	-3.51								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Peer problems

1. Null Model

In the null model, without adding in any predictor variables for peer problems, the preschool level intra-class correlation coefficient *(ICC)* was .15%, suggesting that there was little preschool level difference between children linked to peer problems. The Akaike Information Criterion *(AIC)* was 921.93 for the model.

Table 4.52 Null Model for Parent-report Peer problems at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	1.26***	.14	99.85%
School level residual	.002	.018	.15%
AIC	921.93		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child Level Model

Since no child, family characteristics, or home activities were significantly associated with parent reported peer problems at school entry, they were not entered into the model. Children's peer social problems at preschool (Phase 1) was also tested as predictor variable in the model, and it was the only significant predictor for peer social problems at school entry (*B*=.14, *SE*=.05, *p*=.006).

For children's peer social behaviour from multilevel modelling,

There was little preschool level difference between children in peer social behaviour at school entry. Neither child individual level variables nor preschool level variables were significantly associated with peer social behaviour at school entry. Teacher report peer social problems at preschool (Phase 1), however, was significantly related to peer problems at school entry , suggesting that children who had teacher-report peer social problems at preschool, are also likely to have more parent-report peer problems at school entry.

Prosocial behaviour

1. Null Model

In the null model, the preschool level intra-class correlation coefficient *(ICC)* was 6.61%, indicating that preschool level differences between children could explain approximately 7% of the variance in prosocial behaviour. The preschool level differences were not statistically significant. The Akaike Information Criterion *(AIC)* was 1191.11 for the null model (see Table 4.53).

Table 4.53 Null Model for Parent Report Prosocial Behaviour at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	3.00***	.33	93.39%
School level residual	.21	.16	6.61%
AIC	1191.11		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information riterion; ^{+}p<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child Level Models

No child, family characteristics were significantly associated with prosocial behaviour. Home activities in Phase 1-learning activities, peer social activities and regularity were all significantly associated with prosocial behaviour, thus they were tested as explanatory variables in the model.

Home activities

After adding home activity-learning activities, peer social activities and regularity in the model, the preschool level Intra-class correlation coefficient *(ICC)* reduced to 3.71%, a reduction (*ΔICC*=2.90%) from the null model indicating that these variables together explained almost 3% of the variation. The Akaike Information Criterion *(AIC)* was 1168.67, with a significant chi-square test (χ^2 =22.44, *df*=3, *p*<.001), indicating that the model was improved significantly over the null model. Table 4.54 presents the estimates of three variables, all of which were significantly and positively associated with more prosocial behaviour at school entry.

Table 4.54 Child Level Model for Parent-report Prosocial Behaviour at School Entry

Variable	*B*	*SE*	*t*
Home activities (Phase 1)			
Intercept	7.43***	.17	43.33
Learning activities	.26*	.12	2.14
Peer social activities	.32**	.11	3.05
Regularity	.37*	.16	2.41
Variance	*B*	*SE*	*ICC*
Child level residual	2.78***	.34	96.29%
School level residual	.11	.13	3.71%
AIC	1168.67		
ΔAIC	22.44		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

3. Preschool Level Model

In correlation analyses, preschool quality, measured by the ECERS-R and the ECERS-E overall score were not significantly associated with prosocial behaviour. However, the ECERS-R subscale-Activities and the ECERS-E subscale-math were both significantly associated with the outcome, thus they were tested separately as explanatory variable in the model. Again, they were no longer significant or improved the model while accounting for home social activities, Thus they were not kept in the model.

For children's prosocial behaviour at school entry from multilevel models

Home activities in Phase 1 at preschool explained approximately 3% of the variation in the individual level model. No child, parent, and family variables, as well as preschool level variables were kept in the model as explanatory variables since they were all not significant. No progress model was built as there was not significant association between teacher report prosocial behaviour at preschool and parent report prosocial behaviour at school entry.

Conclusions

Children who engaged home activities such as learning activities, peer social activities more frequently were likely to have more prosocial behaviour as reported by parents at school entry than children who engaged these activities less often or not at all. Children who have regularity on TV watching time and sleeping time were also likely to have more prosocial behaviour at school entry than children who did not have regularity. No preschool characteristics were found to be significantly associated with prosocial behaviour after accounting for individual level differences.

Behaviour Self-regulation

1. Null Model

In the null model, without adding predictor variables, the preschool level intra-class correlation coefficient *(ICC)* was 4.54%, showing non-significant preschool level differences between children in parent reported self-regulation at school entry. The Akaike Information Criterion *(AIC)* was 1227.03 for the null model (see Table 4.55).

Table 4.55 Null Model for Parent-report Behaviour Regulation at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	3.42***	.30	95.46%
School level residual	.16	.15	4.54%
AIC	1227.03		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Models

In univariate analysis, no child, parent characteristics were significant, however, home activity in Phase 1-learning activities, regularity and Phase 2 individual learning activities were all significantly associated with self-regulation, and thus they were tested as explanatory variables.

<u>*Home activities*</u>

Learning activities and regularity in Phase 1

After adding learning activities and the regularity in the model, the preschool level intra-class correlation coefficient (*ICC*) reduced a little (*ΔICC*=.94%). The Akaike Information Criterion (*AIC*) was 1211.16, with a significant chi-square test (χ^2 =15.866, *df* =2, p<.001), indicating that the model was improved significantly over the null model. Table 4.56 presents the estimates of learning activities and regularity, of which regularity was not significant anymore.

Individual learning activities in Phase 2

After adding in individual learning activities in the model, the preschool level intra-class correlation coefficient (*ICC*) reduced a little over the null model (ΔICC=.64%). The Akaike Information Criterion (*AIC*) was 1220.91, with a significant chi-square test (χ^2=6.12, *df*=1, *p*=.013), indicating that the model was improved significantly over the null model. Table 4.56 presents the estimates of individual learning activities of which was significantly associated with more self-regulation behaviour.

3. Preschool Level Models

Preschool characteristic-teachers' qualification was tested as an explanatory variable in the model. However, it was not significant (*B*=.09, *SE*=.15, *p*=.559), after taking children's home learning activities into consideration. Thus it was not kept in the model.

For children's self-regulation at school entry from multilevel models, there were non-significant preschool level differences explaining less than 5% of the variance. Children's home activity at preschool and at school entry separately explained less than 1% of the variation in the model. No preschool level variables were kept in the model as they were neither significant in multivariate analyses nor improving the model significantly. No progress model was built as there were not significant associations between teacher report social development outcomes at preschool and parent report behaviour regulation at school entry.

Conclusions

Children who engaged in learning activities more often at home (measured at preschool or school entry) were likely on average to have more behaviour self-regulation reported by parents at school entry than children engaged in these activities less often.

Table 4.56 Child Level Models for Parent-report Behaviour Self-regulation at School Entry from MLM

				Child level residual			Preschool residual			*AIC*	*ΔAIC*
Variable	*B*	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*		
Home activities (Phase 1)				3.22***	.29	96.40%	.12	.13	3.60%	1211.16	15.87
Intercept	6.56***	.15	43.09								
Learning activities	.39**	.14	2.83								
Regularity	.28	.18	1.60								
Home activities (Phase 2)				3.42***	.289	96.10%	.14	.14	3.90%	1220.91	6.12
Intercept	6.56***	.16	41.78								
Individual learning (Phase 2)	.32*	.13	2.42								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Cooperation

1. Null Model

In the null model, without any predictor variables for cooperation, the preschool level intra-class correlation coefficient (*ICC*) was 4.53%, indicating that the preschool level differences between children could explain approximately 5% of the variances in cooperation, and the preschool level influence was not significant (see Table 4.57).

Table 4.57 Null Model for Parent-report Cooperation at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	3.55***	.35	95.47%
School level residual	.17	.13	4.53%
AIC	1238.37		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

2. Child Level Models

In univariate analysis, none of the child and parent characteristics were significant. Therefore none were added into the model. Home activities in Phase 1 and Phase 2 were significantly associated with cooperation and they were tested as explanatory variables in the model.

Home activities

Learning activities and regularity in Phase 1

After adding in learning activities and regularity in the model, the preschool level intra-class correlation coefficient (*ICC*) reduced a little (*ΔICC*=1.09). The Akaike

Information Criterion (*AIC*) was 1224.17, with a significant chi-square test (χ^2=14.202, *df*=2, *p*<.001), indicating that the model was improved significantly over the null model. Table 4.58 presents the estimates of predictor variables of which regularity was not significant.

Individual learning activities in Phase 2

After adding individual learning activities (Phase 2) in the model, the preschool level intra-class correlation coefficient (*ICC*) reduced a little (ΔICC=.31%). The Akaike Information Criterion (*AIC*) was 1231.23, with a significant chi-square test (χ^2=7.146, *df*=1, *p*=.008), indicating that the model was improved significantly over the null model. Table 4.58 presents the estimates of individual learning activities, and it was approaching significance.

For children's behaviour self-regulation at school entry from multilevel models, Preschool level differences explained less than 5% of the variation in the null model. Home activity at preschool and school entry separately explained less than 1% of the variation in self-regulation. No preschool level variables were kept in the model as explanatory variables in the model. No progress model was built as there were not significant associations between teacher report social development outcomes at preschool and parent report cooperation behaviour at school entry.

Conclusions

Children who engaged in learning activities more often at home either at preschool or at school entry were likely on average to show more behaviour self-regulation at school entry than children who engaged in less often.

Table 4.58 Child Level Models for Cooperation at School Entry

				Child level residual			Preschool level residual				
Variable	*B*	*SE*	*t*	*B*	*SE*	*ICC*	*B*	*SE*	*ICC*	*AIC*	*ΔAIC*
Home activities (Phase 1)				3.37***	.39	96.56%	.12	.11	3.44%	1224.17	14.20
Intercept	7.05***	.17	41.56								
Learning activities	.32*	.13	2.50								
Regularity	.33	.20	1.65								
Home activities (Phase 2)				3.45***	.36	95.78%	.15	.13	4.22%	1231.23	7.15
Intercept	7.05***	.18	39.98								
Individual learning	.33^{+}	.16	2.08								

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Emotional deregulations

1. Null Model

In null model, without adding predictor variables, the preschool level intra-class correlation coefficient *(ICC)* was 2.82% suggesting there was non-significant preschool level difference between children in emotional dysregulation (see Table 4.59). The Akaike Information Criterion (AIC) was 1271.65.

Table 4.59 Null Model for Parent- report Emotional Dysregulation at School Entry

Variance	*B*	*SE*	*ICC*
Child level residual	4.01***	.38	97.18%
Preschool level residual	.12	.13	2.82%
AIC	1271.65		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

2. Child Level Model

In univariate analysis, home activities in Phase 2-individual learning and family activities were both significant, therefore they were tested as explanatory variables. l.

Home activities

Individual learning and family activities (Phase 2)

After adding in individual learning and family activities in the model, the preschool level intra-class correlation coefficient *(ICC)* reduced a little (ΔICC=1.47). The Akaike Information Criterion (*AIC*) was 1264.78, with a significant chi-square test (χ^2=6.87, *df*=2, *p*=.03) suggesting that the model was improved significantly. Table 4.60 presents the estimates of these two variables, neither of which was significant.

Table 4.60 Child Level Model for Emotional Dysregulation Behaviour at School Entry

Variable	*B*	*SE*	*t*
Intercept	2.69	.14	18.73
Individual learning (Phase 2)	-.29	.18	-1.62
Family activities (Phase 2)	-.25	.16	-1.55
Variance	*B*	*SE*	*ICC*
Child level residual	3.93***	.36	98.65%
School level residual	.06	.11	1.35%
AIC	1264.78		
ΔAIC	6.87		

Note: *ICC*=Intra-class correlation coefficient; *AIC*= The Akaike information criterion; ^{+}p<.10, *p<.05, **p<.01, ***p<.001

3. Preschool Level Model

No preschool level variables were entered as they were not significant in univariate analyses.

For children's emotional dysregulation at school entry in multilevel models,

There was no significant preschool level difference effect in emotional dysregulation. Adding children's home learning activities reported by parents at school entry as explanatory variable, improved the model significantly over null model. No preschool level variables were added into model as explanatory variables. No progress model was built as there were no significant associations between teacher report social development outcomes at preschool and parent report emotional dysregulation at school entry.

<u>*Conclusions*</u>

Children’s home learning activities was significantly and negatively associated with parent report emotional dysregulation problems. Children who engaged in activities such as drawing, playing with friends and visiting activities more frequently were likely to have fewer parent report emotional dysregulation problems at school entry. Neither children’s cognitive development nor preschool experiences were significantly associated with parent report emotional dysregulation problems at school entry.

Summary

For children's cognitive development

Table 4.61 presents the summary of predictor variables that were significant for cognitive development outcome for both attainment and progress. The key findings are summarised below.

Table 4.61 Summary of Significant Predictors for Cognitive Development Outcomes

	Cognitive outcomes					
Predictors	Phase 1		Phase 2			
	SRC	*GCA*	*VCI*	*PRI*	*GAI*	***Progress model***
Child factors						
Girl vs. boy	***	*				
GCA (Phase 1)						*******
Home activities						
Peer activities	**	**				
Parent factors						
Family income				*	*	*****
Paternal education			**	*	**	******
Preschool factors						
Changing preschools			*			
Teachers qualification	**	**	**	+	+	***n.s.***
ECERS-R	**	**	**	+	*	***n.s.***
ECERS-E	***	**	**	*	**	***n.s.***

Note: + p<.10, *p<.05, **p<.01, ***p<.001; *SRC:* School readiness based on the Bracken Basic Concept Scales-Revised (BBCS-R) School Readiness Composite; *GCA:* General cognitive ability based on the BBCS-R; VCI: verbal ability based on the WISC-Verbal Comprehension Index; PRI: non-verbal ability based on the WISC-Perceptual Reasoning Index; GAI: general cognitive ability based on the WISC-General Ability Index.

Child and family factor influencing outcomes

1. Girls were averagely scoring higher both on the school readiness and general cognitive ability scales at preschool, one year before school entry than boys.

2. Peer social activities was relevant for the school readiness outcome and the general cognitive ability at preschool: children who engaged in playing activities with friends (either at home or elsewhere) more often, were likely on average to score higher on school readiness and general cognitive ability assessment than children who engaged in playing activities less often.

3. Family income and paternal education were both relevant at school entry (Phase 2): children from higher income families, with better educated father were likely, on average, to have better nonverbal ability and general cognitive ability at school entry, than children with less well educated father and from lower income families.

4. Separately, changing preschool centre (before the beginning of the study) and with a better educated father were significantly related to better verbal ability at school entry (Phase 2), than children who stayed in the same centre and with a less well educated father.

5. Children's general cognitive ability assessed at the beginning of study (one year before school entry) was significantly and positively related to better cognitive development at school entry, even after accounting for influencing factors such as family income and paternal education.

Preschool factor influencing outcomes

After taking child and family influencing factors into consideration,

6. The teachers' qualification was relevant for school readiness and general cognitive ability at preschool: Children who were taught by preschool teachers with high school level background or better were likely to gain higher Bracken scores than those who were taught by teachers with lower levels of education.

7. Children experienced higher quality preschools based on *ECERS-R* or *ECERS-E* assessment were more likely to gain higher Bracken scores than those who experienced lower quality preschool settings.

8. The teachers' qualification and preschool centre quality (based on ECERS-R or ECERS-E) were both relevant for cognitive outcomes at school entry: Children with better educated preschool teachers or from higher quality preschools were on average to have better cognitive outcomes at school entry than children who were from lower quality preschools or with less educated preschool teachers.

9. However, there are no significant additional effects of teachers' qualification and preschool quality on cognitive development after phase 1 (one year before school entry), hence no effect on progress were detected from phase 1 to Phase 2, after accounting for child and family influencing factors such as family income, paternal education and preschool cognitive ability.

10. Other factors which were also tested as predictor variables includes child birth weight, birth order, single child or not, parental education, family income, family structure, mother's age at birth, main care history before preschool entry, age of preschool attendance, classroom size and teachers' experience. They were not significant in the model and the model was also not improved after adding in these variables, therefore, they were not kept in the final model.

For children's social development outcomes

The key results for social outcomes are summarised below (Table 4.62 and 4.63).

Child and family factor influencing outcomes

1. Younger children were likely to have more emotional symptoms reported by teachers at preschool and by parents at school entry than older children.

2. Girls were likely, on average, to have more pro social behaviour reported by teachers at preschool (Phase 1) than boys.

3. Children with heavier birth weight were likely, on average, to have fewer teacher report- emotional symptoms and hyperactivity behaviour at preschool (Phase 1) than children with lower birth weight.

4. There was a trend for children from families that earned 30K Chinese Yuan or less, to have more peer social problems reported by teachers at preschool, than children from families that earned more than 30K Chinese Yuan.

5. Peer social activities at Phase 1 was relevant for teacher report- peer social problems at preschool: Children who engaged in playing activities with friends more often, were likely to have fewer teacher report peer social problems than children who engaged less often.

6. Aspects of home activities at Phase 1 were relevant for social development at school entry: Children who engaged in learning activities more often, and who had regular TV watching and sleeping times, were likely, on average, to have fewer parent report conduct problems, hyperactivity behaviour, and more prosocial behaviour, behaviour self-regulation and cooperation behaviour than children who engaged in those activities less often.

7. Aspects of home activities at Phase 2 were also relevant for social development at school entry: Children who engaged in learning activities more often at school entry, were likely on average, to have fewer emotional symptoms, hyperactivity problems, and more behaviour regulation and cooperation behaviour reported by parents at school entry. Moreover, children who engaged in family activities more often were likely to have fewer emotional symptoms at school entry as well.

Preschool factor influencing outcomes

After taking child and family relevant factors into consideration,

8. Staff: child ratio was still relevant for conduct problems but not for other aspects of behaviour outcomes at preschool.

9. There was a trend for children from higher quality preschool setting (ECERS-R or ECERs-E) to have fewer hyperactivity problems, peer relation problems, but more prosocial behaviours reported by teachers at preschool (Phase 1).

10. No significant preschool factors were detected for social development at school entry.
11. Other factors which were also tested as predictor variables include child birth order, single child or not, parental education, mother's age, main care history before preschool entry, family structure, age of preschool attendance, classroom size, and teachers' qualification. Again, since they were not significant and also the model was not improved after adding in these variables, they were not kept in the final model.

Table 4.62 Summary of Significant Predictors for Social Development at Preschool

	Social development at Phase 1 (one year before school entry)				
	Emotional symptoms	Conduct problems	Hyperactivity	Peer social problems	Pro social behaviour
Child factors					
Age	Neg. $^{+}$				
Girl *VS* boy		Neg. non-sig.	Neg. *		***
Birth weight	Neg. **		Neg.$^{+}$		
Parent factors					
Family income				$^{+}$	
Home activities					
Peer social activities				Neg. ***	
Preschool factors					
Staff: child ratio		*			
Teaching experience				Neg. *	
ECERS-R/ ECERS-E			Neg. $^{+}$	Neg. *	*

Note: + *p*<.10, **p*<.05, ***p*<.01, ****p*<.001

Table 4.63 Summary of Significant Predictors for Social Development at School Entry

Predictors	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour	Behaviour regulation	Cooperation	Emotional dysregulation
Child factors								
Age	Neg. *							
Peer problems (Phase 1)				**				
Home activities (Phase 1)								
Peer activity					**			
Learning activities		Neg. *	Neg. *		*	**	*	
Regularity		Neg. **	Neg. *		*			
Home activities (Phase 2)								
Individual learning	Neg.***		Neg. ***			*	+	Neg. n.s.
Family activities	Neg. *							Neg. n.s.

Note: ^{+}p<.10, *p<.05, **p<.01, ***p<.001

Chapter 5 Discussion

This study aimed to explore the relevance of home and preschool centre experiences for children's cognitive and social behaviour development at school entry in rural China. Two main research questions were asked: 1) Are preschool home activities and preschool centre experiences relevant to cognitive and social behaviour development at school entry; and 2) if yes, how much do they contribute to development outcomes at school entry? Chapter 4 presented the results from the multilevel model analysis and it revealed that preschool home activities and the preschool centre experience are both relevant for cognitive and social development outcomes at preschool (Phase 1) and later at school entry (Phase 2). However, to what extent and which aspects of experiences at home and at preschool are relevant for domains and stages of development, and also how do such experiences vary with child and family backgrounds?

As stated earlier in Chapter 1, the current study was influenced by conceptual ideas in ecological systems theory concerning how child wellbeing is affected by the social contexts, both proximal and distal, in which children are embedded (Bronfenbrenner, 1986; Bronfenbrenner & Morris, 1998). Bearing this in mind this chapter starts by firstly discussing the possible influences of child and family background upon child development. Secondly, the relevance of preschool home activities, which reflects the interactions between parents and child at home, is discussed. Thirdly, the relevance of preschool experience, which is usually deemed a micro-environment for child development, as is the home environment, is discussed after taking family background influences and the home learning environment into consideration. Fourth, implications for policy and practice are discussed in the context of the early childhood education and care development in China. Finally, limitations of the study are reported followed by a brief conclusion with ideas for future study.

5.1 The Relevance of Demographic and Background Characteristics

In this study, children and their families were clustered in preschool centres which had been randomly selected from a registered preschool centre list provided by the local education department. However, as an observational study in natural settings, the children cannot be assigned equally according to their backgrounds into specific preschool centres, and therefore the demographic and family background characteristic influences should be considered.

5.1.1 Social Economic Status

It is well documented that there is relationship between social economic status (SES) and child wellbeing including health, cognitive and academic performance, social and behavioural development as well as language development (Bornstein & Bradley, 2014; Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Dearing et al., 2001; Duncan & Magnuson, 2005; Fernald, Marchman, & Weisleder, 2013). The findings derived from the current study partly replicate the relationship in that family characteristics such as parental education and family income, that are often considered markers for SES, were relevant for cognitive and social behaviour development at school entry.

Firstly, paternal education was found to be significantly related to children's cognitive development at school entry. Children with a better educated father were likely, on average, to have better cognitive outcomes at school entry in terms of verbal ability, non-verbal ability and general cognitive ability. Moreover, even after accounting for cognitive ability measured at the start of the study (Phase 1), paternal education was still relevant for progress in cognitive development up to school entry (Phase 2).

In many studies (e.g., Bradley & Corwyn, 2002; Carneiro et al., 2007, 2013; Melhuish et al., 2008; Mercy & Steelman, 1982; Scarr & Weinberg, 1978), maternal education is generally a stronger predictor for cognitive development than paternal education. In this study, however, maternal education was no longer significant after adding paternal education into the model, which suggests that paternal education is a stronger indicator for cognitive outcomes in this rural Chinese sample.

This discrepancy may reflect differences in the ages of the children assessed. Children's mean age in this study was 69 months at preschool (Phase 1) and then was 80 months at school entry (Phase 2), while in other studies children were often much younger (e.g., 36 months old). Also, the difference might be caused by differences in the population sampled. Most previous studies occur in Western countries and this study is in rural China. Hence cultural differences between the studies will be extensive. It could also be related to the general trend for mothers in the study to have fewer qualifications than the fathers, reflecting differing gender opportunities in rural Chinese society. Maternal education equal to college was significantly associated with better verbal ability at school entry, but children into this group were under represented in the sample (*N*=11, 3%).

Secondly, family income was significantly related to non-verbal ability and general cognitive ability at school entry in multilevel models. Children from higher income families were likely, on average, to have better cognitive ability at school entry, and together with paternal education, income explained around 3% of the variance.

Moreover, paternal education was significantly related to family income, in that better educated fathers (and mothers) were also likely to have higher family income. Again, paternal education and family income were both related to cognitive outcomes. Bearing these associations in mind, the findings from the cognitive outcome models suggest that advantaged family backgrounds such as higher paternal education and higher family income are important for better cognitive development at school entry.

For the domain of social development, family income was also relevant. Children from higher income families were likely to have fewer teacher-reported peer relationship problems than children from lower income families. Similar results have been found in studies in Western societies, that in middle childhood, low SES was related to poorer social development, especially externalising problems (Bradley & Corwyn, 2002). Other studies in a Chinese cultural context also reported that children from higher income families appeared to have higher social ability, and that associations were mediated by the home environments (Li et al., 2012, 2013; Zhang et al., 2009). Overall these findings confirm the assumptions that SES matters and the SES inequality exists at, or even prior to, preschool and is related to differences in children's development at school entry in rural China.

5.1.2. Age, Gender and Birth Weight

Child characteristics such as gender, birth weight, birth order, and single child were all taken into account in this study as they might exert influences on development outcomes, and it is important to establish the extent to which these child characteristics may influence the outcomes before looking at the preschool and home learning environment influences on children.

Age

The effect of age mainly appeared for the social outcome of emotional symptoms as reported by preschool teachers at preschool and by parents at school entry. Younger children were said to have, on average, more emotional symptoms by preschool teachers (Phase 1) and parents (Phase 2). No age differences were detected for other aspects of social development.

For the domain of cognitive development, there was weak to modest (r=.181-.273) association between child age and cognitive outcomes in univariate analysis based on the raw assessment scores, which is to be expected. However, as the main aim of this study was to explore the relevance of early experience at home and preschool and the background factor influence should be controlled, age standardized cognitive outcomes were calculated to use in subsequent analyses.

Gender

Gender differences were detected both in cognitive outcomes and social outcomes at the start of the study (Phase 1) but not at school entry (Phase 2). Girls were doing better in school readiness and general cognitive ability assessment than boys during preschool (Phase 1). For the domain of social development, girls were likely, on average, to have less hyperactivity behaviour and more pro social behaviour reported by teachers at preschool. Significant gender difference were not detected at school entry both either cognitive or behaviour outcomes in this study. This corresponds with other researches from rural China, reported only small non-significant gender differences in cognitive development at school entry (Zhang, 2013; Zhang et al., 2010).

Birth weight

Children's birth weight was reported by their parents or guardians and only eight children were born with low birth weight (<=2500g). Therefore the category of low birth weight was not used as a predictor variable, but birth weight as a continuous variable was entered into analyses. It was found that birth weight was related to teacher-reported hyperactivity behaviour and emotional symptoms, in that children with higher birth weight were likely, on average, to have fewer teacher-reported emotional symptoms and less hyperactivity behaviour than children with lower birth weight. However, as boys were likely to have higher birth weight (g) than girls in the sample, birth weight effects were tested separately for boys and girls on emotional symptoms and hyperactivity, and it was found that birth weight only mattered for boys but not for girls. It is unclear why birth weight effects for behaviour outcomes vary with gender, but it does indicate that when looking at children's emotional symptoms and hyperactivity behaviour, gender and birth weight should both be taken into consideration.

Overall, certain child and family background factors were found to be relevant for predicting cognitive and social development differences between children and it is necessary to take those factors into consideration when taking further investigation on whether the home learning environment and preschool experience matters for development outcomes at school entry.

5.2 Questions 1: Are Preschool Home Activities relevant?

Children spend most of their time at home during early childhood and their early experiences at home, especially with parents or other caregivers can provide them with developmental opportunities. In terms of which kinds of home experiences could be beneficial for children, many studies document the relationship of home literacy experiences, home numeracy experiences, and home social activities to children's reading skills, math performance, language development as well as behaviour development. There is growing evidence that high quality in the home learning environment can be beneficial for school readiness, language development, cognitive ability and school achievement, although the strength of such associations may vary with cultures and SES (Anders et al., 2012; Bradley et al., 2001; Bradley, 2002; Melhuish et al., 2008; Miller, Farkas, Vandell, & Duncan, 2014; Son & Morrison., 2010; Skwarchuck, 2009; Skwarchuk, Sowinski, & LeFevre, 2014).

In current study, children's preschool home activities were shown to be important in predicting children's development outcomes before school entry. However, of which aspects and to what extent home activities are relevant for development outcomes at school entry vary from domains of child development and the timing of assessment.

For the domain of cognitive development, a specific aspect of home learning environment- *peer social activities*- was significantly related to school readiness and general cognitive ability at the start of the study (Phase 1). Children who engaged in more play activity with friends either at home or elsewhere were likely, on average, to have better cognitive outcomes at preschool. Playing with friends might provide more developmental opportunities and stimulation that may be good for cognitive development during preschool.

However, unlike the findings derived from other reviewed studies (Bakermans-Kranenburg et al., 2005; Bradley & Caldwell, 1995; Melhuish et al., 2008), children's individual learning activities (such as reading, writing, counting) reported by parents in this study were not significantly related to cognitive outcomes either at preschool or at school entry in multilevel models in which the preschool centre difference and the demographic background difference were both considered.

Several possible explanations were considered. Firstly, it may due to the underlying associations between the home learning activities and certain background factors (such as single child, family income, and parental education) which were also included in analyses. The home learning activities effects for children's cognitive development at school entry might be moderated by the background SES and the preschool experience.

It may also be that parents in rural China engage in fewer learning activities in the home with their children than parents of studies from the UK and the US, leaving that kind of experiences more to the educational settings. Aspects of the home learning environment such as family activities and individual learning activities were both significantly related to preschool centre quality, suggesting that parents who are more concerned about their children's development may have sought out better centres; the preschool centre quality was related to cognitive outcomes at school entry. Therefore further studies need to explore how those underlying associations between the home learning environment, child background factors and preschool centre characteristics might affect the home learning environment influences upon cognitive development.

An interesting phenomenon that appeared in analysing home learning activities was that parents who reported children engaging in learning activities such as reading, writing and counting more often at home had children who scored lower in cognitive assessment. This is the opposite of findings reported from many studies which suggested that children who engaged in learning activities more often during the preschool period usually have better cognitive development and academic skills at preschool and later at the start of school (Anders et al., 2012; Melhuish et al., 2008; li et al., 2012).

Why are the results different from other studies? A possible explanation is the age difference from some other studies. The age group in this study is 69 months while in some of the studies the children are much younger at 36 months. Also children in this sample were experiencing the last year of preschool education and were preparing for primary school and there were usually certain learning and teaching activities involved at this stage both at preschool and at home. It was high likely that children who were reported by parents as involved in more learning activities at home, were also those who were doing less well at preschool and therefore needed more help from their parents. An increase in home learning appeared to be a remedial strategy for parents, while those whose children were more advanced relaxed at home with respect to learning, letting the school have the responsibility.

This argument is further supported by one particular Chinese study, which also reported similar findings in early primary school. Negative associations were found between parent report reading and numeracy activities at Grade 1and 2 with poor numeracy and reading skills at Grade 2. Deng and Colleagues (2015) argued that those parents engaged in numeracy and literacy activities more often at home might have noticed (either by themselves or through teachers' feedback) that their children were not doing well in schools and thus they need extra helps at home.

This phenomenon was also found in the EPPE study where children doing less well in literacy at school at age 7 years of age were read to more often at home, while children who were read to more often at 3 years of age had better literacy at 7 years of age (Sammons et al., 2004).

Nevertheless, these 'unexpected' results highlight the 'complexity' mechanisms or paths of how the home learning environment, in joint with preschool programmes, can possible affect child development. Reversely, children's development may also affect parents' behaviours in when and how to provide supporting home environment to children. Also, this arouses the further research question that, for those children who achieved less well than their counterparts in preschools and at school entry, do parents provide more stimulating learning activities help children with better cognitive and academic performance? Such studies are particularly needed and useful in China with any attempts to improving the wellbeing of children in less developed rural area.

For the domain of social development at the start of the study (Phase 1), the findings are complex. More peer social activities in Phase 1were related to fewer teacher-reported peer relationship problems at preschool. This is consistent with the finding from the EPPE study (Sylva et al., 2012), which found that children whose parents reported that their child often played with friends at home showed higher scores for both the 'Independence and Concentration' and the 'Peer Sociability' factors than those whose parents indicated their child never played with friends at home.

It is understandable that the more often children played with friends as reported by parents, the fewer peer relationship problems were reported by preschool teachers, though it may also be the case that children with few social skills are not welcomed as playmates and invitations to have a friend to play are rejected. Nevertheless, more playing opportunity might be helpful in fostering social competence and hence reducing peer relationship problems.

No significant associations were detected between home learning activities, parental teaching activities and regularity and teacher report emotional symptoms, conduct problems, hyperactivity and pro social behaviours at preschool (Phase 1). Again, it is worth noting that the associations between these home activities and certain child background factors might moderate the effects of home learning environment. Also, since children's social behaviour outcomes were reported by preschool teachers (Phase 1) whereas the home learning activities were based on parents report during interview, the extent of associations between the home learning environment and children's behaviour development may not be wholly revealed.

For the domain of social development at school entry (Phase 2), the findings are different. It appeared that the regularity of sleeping time and TV watching mattered. Children with more regularity for TV watching and sleeping time were likely to have fewer conduct problems, hyperactivity behaviour and more pro social behaviour, self-regulation behaviour (as reported by parents) at school entry than children who had less regularity. As researchers in the EPPE study explained, the regularity of home activities may be considered a marker for the quality of parenting and in particular the degree of structure to children's home life (Sylva et al., 2012).

A study used data from the UK Millennium Cohort Study (n=10230, 7-year-olds) also revealed that children with non-regular bedtimes had more behavioural difficulties and suggested that irregular bedtimes could disrupt natural body rhythms and cause sleep deprivation, undermining brain maturation and the ability to regulate certain behaviours (Kelly, Kelly, and Sacker, 2013). Nevertheless, the findings highlight the importance of regularity in certain home activities such as TV watching and sleeping time, as irregular activities could potentially lead to more behaviour problems.

Moreover, learning activities in the home, both in Phase 1 and 2, were related to parent report social outcomes at school entry (Phase 2). Children who engaged in learning activities and peer social activities more often at home during preschool (Phase 1), were likely to have fewer parent report conduct problems, hyperactivity behaviour and more pro social behaviours reported at school entry than children who engaged in these types of activity less often or not at all. Similarly, children reported by parents to engage in more learning activities at home at school entry (Phase 2) were likely to have fewer emotional symptoms, conduct problems, less hyperactivity, and more behaviour self-regulation and cooperation behaviour at school entry as reported by parents than children who engaged in these activities less often or not at all. These findings are consistent with findings from reviewed literature that the home literacy or numeracy environment associated with better social emotional outcomes, such as positive approaches to learning (e.g. sustained attention) and fewer negative behaviour problems (Baker, 2013; Faster, et al., 2005; Li et al., 2013).

Overall, these findings suggest that preschool home activities do relate to various cognitive and social development outcomes during preschool and at school entry. As revealed in correlation analysis in Chapter 4 (see Table 4.6), aspects of preschool home activities were only moderately (r<.25) associated with family income and parental education, indicating that low *SES* homes sometimes score highly and, conversely, high *SES* homes sometimes score poorly on the home learning environment measure. The EPPE study (Melhuish et al., 2008) reported similar relationships that there was only a moderate correlation of about 0.3 between the Home Learning Environment (HLE) and parental education and social class. In some circumstances, better/higher educated parents sometimes reported lower frequency of children's preschool home activities than less educated parents. In other words, the parent interview form of home learning environment in this study was related moderately (around 0.25) with parent social class and therefore they were somewhat independent measures. Bearing this in mind, in this case, it appeared that the preschool home activities were more relevant for parent report behaviour development at school entry, while for cognitive outcomes, the paternal education and family income appeared to be stronger indicators.

The appropriateness of the home learning environment measurement

One issue worthy of discussion, however, is the appropriateness of the home learning environment or home activities assessment measure in this study. The home activities questionnaire used in current study was largely influenced by the home environment questionnaires developed in Western culture context, which are usually grouped according to the activities that children engaged in with their parents interactively at home (Anders et al., 2012; Melhuish et al., 2008; Miller et al., 2014; Son & Morrison., 2010).

Chinese literature studying home learning environment are also influenced by those Western researches and generally described the home learning environment from the perspective home literature and/or numeracy environment (Deng et al., 2015), or broadly in terms of the home learning activities (e.g. reading, writing, counting) and enriching life experience activities (such as going shopping and visiting libraries) (Sun, 2008; Li et al., 2013).

Similar to these studies mentioned above, the home learning environment in current study were represented by four kinds of home activities (learning activities; family activities; peer activities and regularity) at preschool (Phase 1) and three kinds of activities (parental teaching activities; individual learning activities and family activities) at school entry (Phase 2), based on the exploratory factor analyses. Whether these home activities which are valued as learning opportunities at home by parents in Western cultures, are also equally valued by Chinese parents in rural area as learning opportunities is an issue of concern and further studies are needed in the future to answer this concern. There are arguments that Chinese parents engage in their children's learning more frequently than parents in the US (Cheung & Pomerantz, 2011; Pan, Gauwain, Liu, & Cheng, 2006). However, there were relatively few literatures studying the home learning environment in China, especially in rural areas, and also no solid evidence were reported on the most appropriate measurement of home learning environment in rural China. The current study, therefore, was only an attempt to draw the picture of the home learning environment in a rural area, and to explore whether these home activities are also relevant for children's development in rural China. Further studies are needed in China to study and develop the most culturally appropriate home learning environment measures in future.

5.3 Question 2: Does Preschool Centre Experience Matter?

One of the major research questions in this study is' *Does preschool centre experience matter? And if the answer is yes, how much does it contribute to cognitive and social/behaviour development at school entry'*? The hypothesis was that 'children with earlier preschool attendance and/or who experienced higher quality preschool will have better cognitive outcomes and fewer behaviour problems at school entry than children who attended preschool at an older age and experienced lower quality preschool'. This section first discusses the preschool level differences in development outcomes, and then which aspects of preschool experiences are relevant in terms of preschool quality, teachers' qualification, stability and other preschool characteristics for children's development outcomes at preschool and at school entry.

5.3.1 Variations in Preschools

Multilevel model analysis was used that allows differentiation between the effects at the child level and the preschool centre level. For the domain of cognitive development, there was a significant preschool level effect on cognitive outcomes at preschool (Phase 1). Around one fifth of the variation in cognitive outcomes was attributed to preschool centre difference (school readiness: 22%, general cognitive ability: 19%). However, at school entry (Phase 2), only up to 10% of the variation was attributable to differences at the preschool centre level for cognitive outcomes (verbal ability: 8%, non-verbal ability: 6% and general cognitive ability: 10%).

Clearly the influence of differences between preschools was decreasing between Phase 1 and Phase 2. One possible explanation is that during this period, preschool influences children development in a way that narrows the cognitive development gap; another possible explanation might be that the different outcome measures at the two phases result in the decreasing influence of preschool centre differences on cognitive outcomes. Another possibility is that preschool effects at Phase 1 were in fact really family level effects, based on different strategies for selecting good quality preschools. Due to the lack of the children's background information and the baseline development outcomes before their preschool entry, it was hard to test this possibility and thus the underlying reason is still unclear.

Also, it is interesting to see that the preschool level variation in non-verbal ability is relatively smaller (6%) than for verbal ability (8%) or for general cognitive ability (10%). In this study, children's non-verbal ability was assessed by the WISC-IV Perceptual Reasoning Index (PRI) which is derived from a child's performance on three core subtests: Block Design, Picture Concepts, and Matrix Reasoning, and emphasizes reasoning in solving the kinds of problems that are not taught in school. Also the school readiness composite (BBCS-R SRC) used in Phase 1 is more related to concepts that can usually be taught by parents or preschool teachers (more ECEC curriculum related), while the general cognitive ability as represented by the BBCS-R overall score, is more focused on measuring general cognitive ability. Thus the assessment in Phase 1 might be more affected by the learning that takes place in preschool, while the WISC-IV is more related to individual differences between children.

The results for social and behaviour outcomes are more complex. The preschool level difference is relatively larger for teacher-reported behaviour outcomes at preschool (Phase 1) than parent-reported behaviour outcomes at school entry. The amount of variance in social behaviour in Phase 1 reported by preschool teachers that could be explained by preschool level differences ranged from 6% to 36%, with a mean variance of 18%, while only up to 10% of the variance in social behaviour at school entry as reported by parents was attributed to preschool centre differences (range: 0.2% - 9.8%).

It is widely acknowledged that parents and preschool teachers see different aspects of children's behaviour development at home and at preschool centre, and therefore it is unsurprisingly that there might be different behaviour outcomes reported from parents and preschool teachers using the same behaviour rating scale. This is also one of the limitations of the study which will be discussed later.

5.3.2 Preschool Quality

The measurement of process quality

As discussed in Chapter 2 (ECEC development in China), there are still some arguments on 'what are higher quality preschool educations' in Chinese culture. However, certain discussion basement or ground are gradually accepted that both the 'hardware environment' and 'software environment' in preschool centres are important for children development, although further studies are still needed to explore how these two aspects of environment are interacted with each other and in what way, to what extent they are influencing children's development, functioning together with family environment.

In current study, the notion 'quality' of preschool education was consistent with the definition of 'quality' of ECEC in many western studies, such as the NICHD Early Childcare study and the EPPE study, that broadly describe the ECEC environment in terms of 'process quality' and 'structure quality'. This study described the preschool environment in rural China both from the ‘process’ and ‘structure’ aspects, and explored their relevance for cognitive and social development before school entry.

As described in methodology section (Chapter 3), the process quality of preschool education in this study was assessed by the ECERS-R and ECERS-E, and a higher score on these two assessment scales indicates a better quality of preschool centre experience. It was reported in Chapter 4 that the mean quality score of sample preschools in this study was 3.17 out of 7 (SD=.63, range 2 to 4) on ECERS-R and was 3.10 out of 7 (SD=.68, range 2 to 4) (see Table 4.7). These scores are lower than Hu and colleagues’ study (2009) (Mean=4.32 out of 7), which recruited 40 preschool classrooms in Beijing City, but was slightly higher than in Rao and colleagues’ report (2012), which recruited preschool centres in a less developed rural area in Western China (Mean=3.07 out of 7 based on 6 subscales included).

Rather similar to Hu’s study, the subscale of ECERS-R-Programme Structure (Mean=2.39, range 2 to 3) and Activities (Mean=2.89, range 2 to 4) of preschool centres in this study, were also scored lower amongst the seven subscales of ECERS-R, suggests that these two aspects of environment in preschool centres in Chinese kindergartens may not be regarded as important as other aspects of environment by teachers and staffs. Nevertheless, in relating to these prior research which also measured the ‘process quality’ of preschool centres in Chinese context, it suggests that using the ECERS-R and ECERS-E in this rural area in China can describe the process quality difference between centres.

Process quality relates to development outcomes before school entry

One of the hypotheses in this study is that ’children who experienced higher quality preschool centre experiences are likely to have better cognitive ability and social development outcomes at school entry’.

With regard to the findings reported in Chapter 4, they partly supported the hypothesis for cognitive outcomes at preschool or school entry, with certain aspects of preschool centre quality being related to teacher-reported behaviour outcomes at preschool (Phase 1). However no significant associations with preschool quality were detected for parent-reported behaviour outcomes at school entry (Phase 2).

The results from the cognitive outcomes models revealed that higher quality of preschool centre was significantly associated with better school readiness and general cognitive ability at preschool, one year before school entry, and also associated with better verbal ability, non-verbal ability and general cognitive ability, 11 months later at school entry.

These findings are consistent with studies from the US, the UK and other countries that early experiences at preschool, especially high quality preschool is associated with better school readiness and cognitive development (Abreu-Lima, et al., 2013; Belsky et al., 2007; Burger, 2010; Gromley et al., 2005; Keys et al., 2014; Li, Farkas, Duncan, Burchinal, & Vandell, 2013; Loeb et al., 2007; Magnuson, Ruhm, & Waldfogel, 2004; Mashburn et al., 2008; Mathers et al., 2014; Peisner-Feinberg et al., 2001; Sylva et al., 2004).

In this study, preschool centre quality explained 7% to 11% of the variation in cognitive outcomes at preschool (Phase 1), but only around 2% to 3% of the variance at school entry (Phase 2). As with the case of preschool level differences, there was a decreasing influence of preschool quality between Phase 1 and Phase 2. Preschool quality explained less variation in cognitive outcomes at school entry than it did at preschool (Phase 1).

Furthermore, the results of the progress model for cognitive outcome revealed that preschool centre quality was no longer significant for cognitive outcomes at school entry after taking children's general cognitive ability measured at preschool (Phase 1) into consideration, while paternal education and family income were both still relevant for progress in cognitive outcomes. One possible explanation was that preschool centre quality exerts its effects upon cognitive ability early in preschool (Phase 1) with little subsequent effect as the child is prepared for school entry, when preschools may become more similar in the activities offered to children. Another possible explanation was that the centre effects are sleeper effects, i.e., not detectable by the measures used and at the age when children were assessed for phase 2, but may be revealed later.

However, the non-significant relationship in the progress model does not deny the influence of preschool experience prior to Phase 1 upon cognitive development. Ideally, in a progress model, the 'pre-test' outcome (children's school readiness and general cognitive ability at preschool in this case) was assumed to be independent to the predictor variables, and that the effects of predictor variables on 'post-test' outcomes (children's verbal-, non-verbal- and general cognitive ability at school entry in this study) can be detected. In this study, as no baseline cognitive development data were available to be collected before any preschool centre experience occurred it was impossible to build a growth model for development outcomes at school entry to examine the 'pure effects' of preschool experience.

The results from the social behaviour models revealed that with higher quality preschool (based on ECERS-R or ECERS-E) children were likely to have less hyperactivity, fewer peer relation problems and more pro social behaviour as reported by preschool teachers in Phase 1 (at preschool, one year before school entry). The preschool quality could explain 3% to 4% of the variance in hyperactivity, peer problems and pro social behaviour at preschool. However, little evidence of preschool quality influence is shown for social and behaviour outcomes at school entry after accounting for background influencing factors. One thing to bear in mind was that at school entry children's social and behaviour development was measured by the SDQ parent-report version, and as some researchers have suggested parents might report different aspects of behaviour development from teachers at school, and such measures may be less well differentiated between children than teacher-report measures, or less susceptible to preschool centre influence (Stone et al., 2010).

Burchinal and colleagues (2010, 2014) reported that there were thresholds in the association between preschool care quality and child outcomes in rural preschool children in the US. They found that preschool quality was related to children's behavioural outcomes above, but not below, a cut-point, while language, literacy, and working memory did not show evidence of threshold effects. Bearing this in mind, the findings derived from current study, that no significant preschool quality effect was detected for social development at school entry might be due to the threshold effects.

However, due to the fact that both the ECERS-R and ECERS-E measures did not have the standardized norm in Chinese context when this study happened, it is hard to make judgement in this study whether preschool centres are lied in high-, medium-, or low- quality groups base on the assessment. Also, considering the sample size of preschools are relatively smaller (19 preschool centres), the threshold effects was thus not tested in this study.

In the reviewed literature, findings from intervention studies and natural preschool settings have suggested that the quality of preschool experiences plays an important role in shaping children's cognitive and social/behaviour development, and the lasting effects may vary depends on the extent of programme quality. The results concerning preschool quality in this study were consistent with other research findings and also partly confirmed the hypothesis that children experienced higher quality preschool centre were likely on average having better cognitive ability, and certain aspects of preschool centre quality are relevant for social and behaviour development. Variability in preschool quality in rural China may also not be as great as it is in other societies, which could have relevance form the relevance of quality seeming to be less pronounced that it is in much other research.

5.3.3 Teachers' Qualification

Many reviewed studies revealed that preschool staff qualifications were related to children's cognitive development at preschool and also later in primary school (Burchinal, Howes, & Kontos, 2002; Fukkink & Lont, 2007; Sylva et al., 2004). In line with these findings, the results derived from this study indicated that better educated preschool teachers provided higher preschool quality and both these variables were separately related to better cognitive outcomes at preschool and school entry, after accounting for child and family background factors.

The preschool teachers' qualification alone could explain 7%- 8% of variance in cognitive development at preschool but explained only 1%- 2% at school entry in Phase 2. Preschool quality and teachers' qualifications were no longer significant in the progress model at school entry while taking cognitive ability in Phase 1 into account. For social and behaviour outcomes, no significant associations for preschool teachers' qualifications were detected in this study.

It is well documented that preschool teachers' qualifications are linked to preschool quality suggesting that the higher level of preschool staff qualifications would lead to higher observed centre quality. Similar linkages between staff qualifications and preschool quality were found in this study. As mentioned earlier, because of the high associations between teachers' qualifications and preschool quality, they were kept in different multilevel models to avoid collinearity problems, and teachers' qualifications explained less variation than preschool quality did. Better educated teachers in preschools can benefit children's cognitive development at school entry and it highlights the importance and necessity of teachers training for preschool programmes.

5.3.4 Stability of Preschool Experiences

The stability of preschool experience can be broadly interpreted and includes preschool staff stability, daily routine activity stability, as well as children's mobility between preschools.

Due to the inadequate information regarding children's prior preschool experience (children have already in preschools before the study happened), especially for those children who have changed preschool centres, when the stability of preschool experience was mentioned in this study, it refers solely to whether children changed preschool centre or not prior to the current preschool centre at the start of the study. Only the information that whether children had moved preschool centres can be obtained from their parents or preschool teachers.

It was found that changing preschool centre was specifically related to better verbal ability at school entry. Since children's earlier preschool centre experience, especially the centre quality as well as the reason for changing preschool centre information was unknown, it is unclear why changing preschool centre was related to better verbal ability at school entry. Maternal education was related to changing preschools. Hence, a possible explanation is that children who changed preschool centres were more likely to have mothers with higher education, who could identify a centre that was not up to her expectations, and also mothers' educational background was itself related to children's verbal ability.

Another possible explanation was that changing preschool centres provided more stimulation environment for children which can be helpful for developing verbal ability. However, due to the limits of earlier preschool experiences, it is hard to draw a conclusion and therefore further study may be needed to answer this question.

It is worth noting that similar findings were reported from the EPPE study, that the mobility of preschool experience was related to better math achievement in early childhood, and the family advantage, especially the mothers education was related to mobility of preschool experiences, which suggested that mothers with higher education background were more likely to change preschools for their children (Melhuish et al., 2008).

Changing preschools were not significantly associated with school readiness and general cognitive ability at preschool and non-verbal ability and general cognitive ability at school entry. Again, no significant associations were detected between social outcomes and changing preschools.

5.3.5 Age of Attendance

There was a weak trend (r=.11 to .17) suggesting that children who attended preschool centre at an earlier age was likely to have higher cognitive assessment scores. Zhang and colleagues (2011) found non-linear relationship between age of attendance and cognitive development in preschools in China. In the current study, a non-significant trend was detected for children who attended preschool centres at age 2.5 years or younger, to have better cognitive ability both at preschool and at school entry, after accounting for other background factors, home learning environment and preschool influences. Some other studies in China also reported that earlier age of preschool attendance predicted better school readiness and academic outcomes (Li et al., 2014). In the EPPE study (Sylva et al., 2004) in England and the EPPNI study (Melhuish & Quinn, et al., 2006) in Northern Ireland, found that starting preschool as young as 2 years old was associated with better cognitive and social development, but starting below two made no extra difference.

5.3.6 Other Preschool Characteristics

Interestingly, the length of years' experience in teaching appeared to be relevant for teacher-reported peers' relationship problems at preschool but it was not relevant for parent-reported peer problems at school entry. This may again be related to the different informants for phases 1 and 2. Children cared for by preschool teachers with more than 20 years' experience in teaching were likely to have more peer relationship problems reported by preschool teachers than children with preschool teachers have less than 20 years' experience. One possible explanation was that preschool teachers with more years in teaching may see more in children's peer relationship problems as they are more experienced.

However, considering the associations between teaching experience with teachers' qualification and process quality, that teachers with more years in teaching were likely to be with lower qualification/education backgrounds and also in lower quality preschool, another possible explanation might be that those teachers with few years in teaching have received better training in dealing with children's peer problems or they are holding an more open or positive view regarding peers' conflicts.

A staff: child ratio effect was detected for school readiness at preschool (Phase 1) and general cognitive ability at school entry (Phase 2) in one way ANOVA analysis with staff: child ratio as a between-subject predictor variable. However, no significant effect was detected for cognitive outcomes both at Phase 1 and 2 in multilevel models after taking preschool centre differences into consideration. Staff: child ratio was significantly related to teachers' qualification, and preschool centre quality, both of which were relevant to cognitive developments at school entry in multilevel models. Therefore, it appeared that the associations between staff: child ratio and cognitive development might be mediated by preschool centre quality, teachers' qualification or other preschool level differences for children.

Interestingly, the staff: child ratio was found to be significantly associated with teacher reported conduct problem at preschool (Phase 1) in the multilevel model. Children in classrooms with one teacher to 28 children or more were likely on average to have fewer teacher reported conduct problems than children in classroom with one teacher to less than 28 children in this sample. As children's behaviour problems were reported by their classroom teachers, and thus one possible explanation for this finding might be that teachers who are caring more children in classroom might be less likely to detect children's behaviour problems, or they may develop better control strategies to deal with the larger numbers.

Overall, some positive associations were found between preschool quality, teachers' qualifications and children's development outcomes at preschool and school entry. Although some studies have reported negative effects of preschool centre experiences on social and behaviour development, in this study, no negative effects were found on behaviour development in terms of emotional symptoms, conduct problems, hyperactivity, peer relationships problems, prosocial behaviour, behaviour regulation, and cooperation and emotion dysregulation. In summary, higher quality of preschool centre experience could be beneficial for children's cognitive development even taking child background factors and home learning environment into consideration, and while it is inconclusive whether preschool experience could be beneficial for behaviour development, no negative effects were detected in this study either.

5.4 Implications for Early Childhood Education and Care Development in China

Early child care and education in China has achieved a lot since the 1980s after the opening up economy policy and currently is entering a new development era as the public and government attention and investment is larger than ever. However, as discussed in Chapter 2, the ECEC development in China is currently facing some major challenges. One big challenge is the rural-urban disparities, whereas the ECEC development in rural area is far less developed than urban area in various aspects (Feng & Zhang, 2011; Liu, Z. L., 2011c; Shi & Niu, 2007; Yan, Gai, & Liu, 2013; Zhao & Hu, 2008). The public spending, programme accessibility and quality, the kindergarten facilities, resources, as well as teachers training, have been relatively less developed in rural areas. Understanding of how these disparities might influence children’s development and in what way they are influencing children development is critical in making public efforts to develop ECEC service in rural areas.

As discussed in Chapter 2, the policy and public spending preferences in China nowadays are for expanding centre-based preschool services in rural areas in order to achieve the national goal, which was set in 2010 that ‘by 2020 one year of universal preschool education should be provided for all children, with most children having better access to two-years of universal preschool education’ (The State Council, 2010). Little is known about the quality of these expansion programmes and there is growing concern that the programme quality cannot be maintained in expansion process.

In this study, however, it has revealed that higher quality preschool education could be beneficial for children at school entry for children from less advantaged backgrounds such as those in rural areas in China. The implication is that providing universally high quality preschool education for children in rural areas could be a way to facilitate children’s preparedness for school and even to narrow the development gap between children in rural areas and their counterparts from urban areas or more developed areas.

The findings also shed lights on ‘how to improve the quality of preschool settings in rural area in China’. The process quality of preschool centres in current study was assessed using the ECERS-R and ECERS-E measures which were both developed in Western cultures based on a comprehensive view of early childhood development that physical environment, children’s relationships with one another and significant adults, and instruction as intertwined. In this study, positive associations were found between the preschool quality based on these measures and children's school readiness and cognitive development outcomes before school entry in rural China.

It suggests that, apart from improving the physical preschool environments in rural area, which are usually inadequate compared to their urban counterparts, the processes of how teachers and staff are interacting with children and their parents are also critical elements for better quality preschool environment. Therefore, teacher training programmes should be provided in rural area to help teachers in understanding and comprehending the comprehensive view of early childhood development. Training programmes focused on improving teaching skills on organizing learning activities for children, how to interact with children during learning activities as well as how to cooperative with parents and provide supports to parents regarding children's development, should also be considered a way of improving preschool quality in rural China.

This study also revealed that teachers' qualification are relevant for preschool centre quality, and both were related to better cognitive outcomes at school entry, even after accounting for background factors such as family income and parental education. These findings highlight the importance of enhancing teachers' qualifications, which usually can be achieved by improvement in teachers' training programmes, and in-service support for teachers already working. This should ensure better quality preschool centre experiences in the future which should lead to better development outcomes, especially cognitive development, at school entry.

The current study also revealed that the development gap can be identified at school entry and is related to family demographic and income factors. Therefore, children from less advantaged backgrounds or with low *SES* should be provided with extra help in order to catch up with their counterparts before school entry.

Another implication that can be drawn from this study is that the home learning environment might exert an independent influence on children's development while family background factors such as parental education and family income are also important. This suggests that, despite the relatively low parental education and family income in rural area, intervention programmes or projects designed to help parents improve the home learning environment can be beneficial for children, to be better prepared for school. This can be considered as another possible pathway for policy makers in China in improving the well-being of children from disadvantaged backgrounds.

5.5 Limitations

There are limitations to the study that should be noted.

First, this is an observational study that tried to explore associations between children's early experience at home and at preschool centre and their development outcomes before school entry. The results are mainly based on multilevel modelling analysis, which is based on correlation analysis and thus any causal interpretation of the results should be considered with great caution, because of the possible influence of unmeasured variables mediating the association.

Unlike those studies with a randomized controlled trial (RCT) design, the current study cannot assign participants (children and families) into specific designed preschool programmes for research purpose. Instead, children and families in this study chose preschool centres based on their own choices (children were already in preschools for years before they entered to the study), and unavoidably, that might cause some underlying selection bias for this study. For example, it was revealed that in this study, child with better educated parents and from a higher income family was also likely in a higher quality preschool centre and with better educated teachers. Although positive associations were found between preschool quality and children's development before school entry in this study, it was unable to determine conclusively any causal effects of preschool experience of children on their development, as the background factors are already existed before children attending preschools and that might cause the development outcomes difference for children.

Second, in an observational study or non-experimental study, there are unobserved or unmeasured characteristics of child, family or preschools which were not taking into consideration in the analysis. These omitted variables may influence the obtained results. It is unclear how they could affect the findings reported in this study as only observed characteristics were used as explanation variables for development outcomes. Also, due to the scale of the study, only a limited range of background characteristics were considered in the analysis and it is unclear that how unmeasured factors could influence the interpreting the results of this study.

A third limitation is the sample size of preschool centres issue. As a study which was aiming to explore the relevance of preschool quality for children's development at school entry, children were recruited only from 19 preschool centres (randomly selected from a 90 centres list) might not be able to provide sufficient preschool centres information of predicting children's development outcomes. It was explained in methodology section (chapter 3) that initially more preschool centres (n=30) were selected for this study. However, due to various unexpected reasons, eleven centres were unable to participate. Whether excluding these centres which were unable to participate in the study can lead to sample bias and how much this can affect the interpretation of results are unable to be known. However, the number of missing centres in each group (A, B, C) are relatively equal (either 3 or 4)**,** and hence it was finally decided that 19 preschool centres sample in this study could adequately represent the 90 registered preschool centres in the study area. This is a judgment that was constrained by resource limitations but seemed reasonable at the time.

Another limitation is the measurement issue. There is a concern that the measurements used in this study were lacking Chinese norms, and therefore this limits the attempts to make comparisons with other international studies. This is a limitation but it does not invalidate comparisons within the study.

One example is the ECERS-R and ECERS-E (Harms et al., 1998; Sylva et al., 2003) that were used in assessing preschool classroom quality in this study. Unlike other studies that were able to make a judgement of whether the childcare or preschool centre environment was below or above the norm quality in the culture context, this study could only make comparisons within the study sample of preschool centres. As mentioned earlier, this also limits the attempt to explore the 'threshold effects' of preschool quality on development outcomes as it was unable to make judgements on whether children were attending a high-, medium- or low- quality preschool based as ECERS-R and ECERS-E scores without Chinese norm.

As explained earlier in methodology section (Chapter 3), the home activities in current were reported by parents during an interview to rate the frequency of home activities and thus the reliability was mainly based on parents self-report. Whether this method can lead to any bias (e.g. social-desirability bias) in report and the potential effects on the results were both unclear. Therefore, further studies perhaps should consider both the self-report measurement as well as the direct observation measurement in order to provide a more complete picture of the home learning environment in rural China.

The different development outcome measures used also present a concern in that they may differ in sensitivity of measurement. One example is the *Strength and Difficulties Questionnaire (SDQ)* (Goodman, 1997) measurement that was used to assess social behaviour development. Ideally, both teacher-reported and parent-reported behaviour should together provide a comprehensive picture of the behaviour of children because parents at home and teachers at school will see different aspects of children's behaviour. In this study, however, due to some unexpected circumstances beyond the researcher's control, parent- reported *SDQ* and teacher-reported *SDQ* were used in different time points, and this should be avoided in future studies.

The measurement issue in this study also highlights the dilemma and difficulties of using methods in a non-western country like China when all the methods are developed in western countries.

On the one hand, these measures developed from Western studies are usually designed under scientific procedures, have been used and tested repeatedly in many studies and reported with high validity and reliability. Whereas in China, there are relatively few child development measures, preschool environment measures as well as home learning environment measures, and thus many Chinese studies (including this study) opted to use the measures that developed in Western cultures. On the other hand, the culture context is an issue that cannot be neglected. Perceptions of what is appropriate behaviour and what might be of concern can differ between different cultures, where for example more or less physical activity is seen to be appropriate in different cultures; whether family or the preschool settings should play more important role in children's development (e.g. many Chinese parents in rural area think the preschools and teachers are mainly responsible for their children's readiness for primary school); whether certain learning activities such as counting, writing are considered equally as learning opportunities as other activities (such as playing with friends, and visiting relatives) may also differ in cultures (e.g. many Chinese parents thinks reading and counting activities are more important than playing with friends). Bearing all these concerns in mind, it is highly and urgently recommended that the development of most appropriate measurements in Chinese context for child development, as well as for home and preschool learning environment assessment, should be priorities in future research in fields of child development and early childhood care and education in China.

A fourth issue concerns the generalizability of the findings. In this study children and families were clustered in preschool centres from X County in an eastern coastal province of China. Although these preschool centres were from the rural area which is usually less developed economically than the urban area in China, the study area is not severely deprived and not the poorest rural area in China such as those area in south western and western part of China. Thus the results reported in this study should not and were not aimed to represent the situation in those poorest areas of China.

Conclusions

Despite the limitations, the current study makes several contributions to knowledge.

First of all, the current study is one of the few studies from China that tried to systematically explore the associations between early experiences both at home and at preschool provisions with development outcomes at school entry. Most of the literature reviewed in Chapter 1 was from developed countries such as the US, UK, Canada, Norway and Germany. Although a few studies were reported from China, most of them involved either only simple correlation analyses between preschool characteristics and development outcomes not accounting for child background differences, or even for those few studies that tried further regression analysis, only one or two background factors (parental education and family income) were taken into consideration. Compared to those large scale studies from the US and UK that take a large variety of background factors into account and employ rather sophisticated research design when exploring the impact of childcare and preschool experiences upon child wellbeing, studies from China have been far simpler in terms of scale and research design.

Second, the current study made an effort to explore associations longitudinally. Although it was only an 11 months period, this study tried to build progress models to examine the effects of the home learning environment and preschool experiences on cognitive and social development at school entry. It is not unusual in studies from the US and UK to employ a longitudinal design in impact studies. However, longitudinal studies in China, especially exploring the influence of home learning environment and preschool experience upon child wellbeing, are still relatively rare and undeveloped. It is commonly acknowledged that longitudinal studies are important and have the value in providing evidence for relevant policies for early childcare and education. Bearing this in mind, the current study could be extended to follow the participant children and families into their primary school years or even later in secondary school in the future study to provide a more complete picture of child development in this study area from China.

Another contribution of this study was the attempt to construct preschool experiences from various aspects of experiences in terms quality, timing and stability. This was mainly influenced by large scale and well recognized studies such as the EPPE study and NICHD Child care study which both explored different aspects of childcare and preschool experiences. The current study went further than other Chinese studies, which only treated children's preschool experiences as one variable (attendance or not; age of attendance). Not only did this study examine the relevance of timing (age) of preschool attendance and stability of experiences, most importantly, it also explored the nature of preschool experiences by looking at quality. It is studying the quality of preschool experiences by doing in classroom observation and screening, as well as looking at the structure of centre quality such as staff qualification, group size and ratios, which provided a more completed picture of children's preschool centre experience in the study.

Fourth, the current study added findings to the literature from the Chinese cultural context, and found that children's early experiences at home and at preschool centre are relevant for their cognitive and social development outcomes at school entry in less developed rural China. It also revealed that the developmental outcome gap at school entry for children in this area already existed and the difference may partially be due to the social economic status inequality at preschool or even earlier years. Such evidence may be useful to the Chinese government wishing to maximize educational achievement and indicates appropriate steps to facilitate children's preparedness for school. Findings from the current study such as this may help guide the appropriate focus of such policies.

Some ideas for further research are considered. One idea for future research is to follow the children in this study into primary school to see if early experiences at home and in preschool centres are still relevant for cognitive and social development as well as school achievement at the end of primary school. In such a study data collection would involve child development outcomes in terms of cognitive development, social development, and academic achievement (e.g., math and literacy). The home learning environment, school learning environment, after school learning programme support, as well as parents and teachers anticipation toward target children should also be considered in such longer-term follow-up studies.

Overall, the current study is one of the few studies from China that systematically explored the associations between children's home learning environment, preschool experiences and their development outcomes both at preschool and school entry from a developmental perspective taking the context of this process at multiple levels into consideration. This study highlights the importance of higher quality of preschool centre experience and better home learning environment for child development at school entry in rural China. In this regard, not only do the results of this study provide an insight into the relevance of early experiences at home and at preschool for development outcomes at school entry in Chinese context, but also it proposes evidence-based ideas for early childcare and education practitioners or policy makers in China who are aiming to provide an better life for children and their families in the future.

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Appendices

Appendix I. Distribution of Preschool Centres and Children

Pre-divided group	Preschools	No. of Children	No. of Girls	ECERS-E (*Mean*)	ECERS-R (*Mean*)	No. of Excluded centre
A	CHZ*	22	12	3.42	3.59	DZC CWY CZX MJ
	CHC*	23	14	4.21	3.98	
	ZH*	26	15	4.42	4.42	
	LQ	21	10	3.22	3.31	
	XF	15	6	3.54	3.52	
	JQ	18	10	3.17	3.40	
Total (Average)	6	125 (41.95%)	67 (53.6%)	3.66	3.70	4
B	LAN	18	5	3.38	2.93	CWE MQ DZX DSY
	XY	14	8	3.29	2.82	
	DZ	16	10	2.84	2.57	
	PJ	11	5	2.25	2.14	
	DG	11	7	2.54	2.76	
	DW	11	7	2.84	2.57	
Total (Average)	6	81 (27.18%)	42 (51.85%)	2.86	2.63	4
C	QJ	8	3	2.33	2.18	XFY LB CP
	LJ	10	5	2.71	2.61	
	LZ	7	3	2.92	3.21	
	BZ	13	7	2.42	3.40	
	JLV	14	6	2.17	2.32	
	TB*	23	11	2.50	2.89	
	LIU	17	7	2.29	2.41	
Total (Average)	7	92 (30.88%)	42 (45.65%)	2.48	2.72	3
Overall (Average)	19	298 (100%)	151 (50.67%)	3.10	3.17	11

Note: * centres with two classrooms

Appendix II. Parent/Guardian Questionnaire (Phase 1)

[English Version]

Interviewer: …………………
Date: ……………………….
Preschool: ………………….
Name of child: …………..

Child Information

1 Index child's name________ date of birth_______, and **gender** (boy/girl)

2 Birth weight _______kg; and **was the child premature?** Yes/No

3 Is index child your only child? If Yes (then go to question 5); If No (then go to question 4)

4 How **many siblings does index child have? What's the birth order of index child?**

5 Dose index child have any longstanding illness, disability or infirmity? If yes, what's the matter?

6 Does index child have any of the following health problems?

1) Minor fits 2) Seizure 3) Epilepsy 4) Febrile fits or convulsion
5) Fainting 6) Blackouts 7) congenital heart disease

7 Has index child suffered from any illness in the last six months?

1) colds 2) coughs 3) breathing difficulties 4) vomiting 5) diarrhoeas
6) listlessness 7) loss of appetite 8)temperature 9) convulsions 10) rash
11) any other illness______________

8 How is index child's health status?

1) Excellent 2) very good 3) good 4) fair 5) poor

9 what age did index child attend this preschool centre? ____ Years ____Months

10 Did index child attend any preschool centres before this one? When started?

Parents' information

11 Is your index child's father, mother or others (ex: grandparents, stepparents..?)

12 Are you a single parent? Yes/No

13 What's mother's age group when she gave birth to the index child?
16-20; 21-25; 26-30; 31-35; 36-40; 41-50; 50+

14 What's the income of the family per year? (Chinese Yuan)
5,000 below; 5,000-10,000; 10,000-20,000; 20,000-30,000; 40,000-50,000; 50,000+

At what's your education level (Primary school; Secondary school; High school or other equivalent level; College or university)
15 Father: ………………………
16Mother: ………………………

17 Who live with index child now in family?
Mother; Father; Sibling; Grandmother; Grandfather; Aunt; Uncle; Cousin; Other

18 What's child's care history like before index child go to preschool centre?
Mostly cared by grandparents; mostly cared by parents (mother/father); Cared by grandparents and parents together; Cared by other relatives___; Cared in child care centre; Cared by Nana.

Child's activities at home

Does index child have?
19 A regular bedtime Yes/no
20 Rules about watching TV/Videos Yes/no

How often has index child?
(7=Everyday; 6=Several times a week; 5=Once or twice a week; 4=Several times a month; 3=Once or twice a month; 2=Less often; 1=Never)
21 Played with friends at home: 1 2 3 4 5 6 7
Generally, what kinds of activities did they play with?

22 Played with friends elsewhere: 1 2 3 4 5 6 7
Do you know what kinds of activities did they usually play with?

23 Sat down and eaten a meal with the whole family together:

1 2 3 4 5 6 7

24 Gone on visits to friends or relatives: 1 2 3 4 5 6 7

25 Gone shopping with parents or others: 1 2 3 4 5 6 7

26 Watching TV/videos: 1 2 3 4 5 6 7

Generally, what kinds of TV/Video programs did index child watch? (Program name)

27 Reading 1 2 3 4 5 6 7

Generally, what kinds of books did index child read? Book's name….

28Painting or drawing 1 2 3 4 5 6 7

Generally, what contents did index child paint or draw?

29 Writing 1 2 3 4 5 6 7

Generally, what did index child writing about?

30 Playing with numbers/Chinese Characters/Pinyin

1 2 3 4 5 6 7

Generally, how did index child play with numbers/Chinese characters/Pinyin?

Does anyone at home ever try to teach index child? (Or do anything with index child like…?) How often?

(7=Everyday; 6=Several times a week; 5=Once or twice a week; 4=Several times a month; 3=Once or twice a month; 2=Less often; 1=Never)

31 Read to child? 1 2 3 4 5 6 7

If Yes, what kind of contents?

32 Paint or draw 1 2 3 4 5 6 7

If yes, what kinds of pictures did you teach them to draw or paint? How did you teach?

33 Writing 1 2 3 4 5 6 7

If yes, what have you taught and how did you teach?

34 Numbers/count/added up 1 2 3 4 5 6 7

If yes, what have you taught and how to teach (relating shapes, colour, or time…..)

35 Chinese Characters/Pinyin 1 2 3 4 5 6 7

If yes, what have you taught and how did you teach?

36 Chinese poems/rhymes/songs 1 2 3 4 5 6 7

If yes, what have you taught and how did you teach?

As you know we will follow index child to their primary school entry, do you know which primary school index child will be going to?

Could we have a name, address and phone number of a close relative in case you move and we need to get in touch? This is index child's ……… (Grandparent, aunts? etc)

Address: ___________Town, __________Village; Telephone number: _______________

Name (Sign here):

Thank you for your time. I hope you find the interview interesting

[Chinese Version]

亲爱的的家长朋友，请依照孩子的具体情况填写以下问卷，以便我们能够准确的分析孩子的“入学准备状态”。问题答案无好坏之分，请您放心做答！谢谢！（比如如果孩子的出生体重为 5.2 斤，则在题目：***出生体重：____斤***中添写 5.2;请在选择题中合适的选项上划√，比如如果您的小孩为男孩，则在题目：***性别：男/女***中选项男上划√）

儿童信息

1) 儿童姓名：____________; 出生日期：___年____月____日（阳历生日）； **性别：**男/女

2) 出生时体重：_______斤；**3) 是否为独生子女？** ①是； ②否

4) 如果不是独生子女，有____个兄/弟/姐/妹？ 在家排行第几？ 1 2 3

5）你的孩子有没有任何身体缺陷？ ①有 ②无 **（如果有的话，请描述一下具体情况；）**

6）你的孩子是否有经过医生确诊的以下这些疾病？

①癫痫（俗称羊癫风）；②哮喘；③先天性心脏病；④昏厥；⑤色盲；⑥耳聋；⑦视力障碍；⑧小儿麻痹；⑨脑瘫；⑩没有；其它问题（请写明）：___________________________________

7）在过去半年的时间里，你的孩子是否有以下健康问题？

①感冒；②咳嗽；③呼吸困难；④呕吐；⑤胃口不好；⑥腹泻；⑦疹；⑧抽搐（惊厥）；⑨发烧

⑩无以上任何问题；其它疾病：____

8）**孩子的健康状况为：** ①非常棒；②很好；③好；④一般;⑤差;⑥很差

9） 你的孩子几岁时参加的幼儿园？ _____岁_______月

10）在进入这个幼儿园之前，你的孩子还参加过其它的幼儿园吗？ ①有；②没有

如果有的话，什么时间开始的：______年_______月

父母/监护人信息

11）**你是孩子的：**①父亲；②母亲；③继父；④继母；其他人（请写明）______________

12） 是否是单亲家庭？ ①是； ②否

13） 母亲生产该儿童时的年龄是：___岁 (16-20; 21-25; 26-30; 31-35; 36-40; 41-50; 50+)

14）父亲的教育背景为：①小学；②初中；③职中或技校；④高中或中专；⑤大专及以上

15）母亲的教育背景为：①小学；②初中；③职中或技校；④高中或中专；⑤大专及以上

16） 每年的家庭收入约为：

①1 万元以内；② 3 万元以内；③ 5 万元以内 ④ 8 万元以内 ⑤ 多于 8 万元

17）现在家中和孩子住在一起的人有：（多项选择）

爸爸；妈妈；继父；继母；兄/弟/姐/妹；爷爷；奶奶；姥姥；姥爷；叔叔；姑姑；舅舅；舅母；表兄妹；其他：____________________________________

18) 孩子在进入幼儿园之前，主要由谁照看？（可多项选择）

①主要是爷爷奶奶或姥姥姥爷照看；②主要有爸爸妈妈照看；③祖父母和父母一起照看；④由其他亲戚照看；⑥其他照看方式：_____________________

儿童家庭活动信息

（以下问题请家长根据孩子在家的具体情况回答，在合适的选项上打√）

19）孩子的作息时间有规律吗？（比如晚上按规定的时间上床休息等）

①有规律 ② 没规律

20）孩子看电视/DVD/电脑有规律吗（比如规定孩子只能在规定的时间看电视或看规定电视时间）？ ①有规律　　② 没规律

21）一般孩子在家和小朋友玩的次数约为（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

22） 在其他地方（不包含幼儿园）和小朋友玩的次数为（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

23）和家人一起吃饭的次数是（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

24）和家人一起走亲戚或拜访朋友的次数是：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

25）和家人赶集或逛商店，超市的次数是：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

26）孩子在家看电视/DVD 的次数是：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

27) 孩子在家阅读小画书，故事书的次数是：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

28) 孩子在家画画的次数约为：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

29) 孩子在家认（写）汉字的次数约为：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

30) 孩子在家摆弄数字/拼音/字母玩具的次数是：（请选择合适的频率）：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

31) 一般来讲，家长给给孩子讲故事，读图画书的次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

32) 家长教孩子（或和孩子一起）画画的次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

33) 家长教孩子写字（比如数字，拼音，汉字等）的 次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

34)家长教孩子数数，算数的次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

35) 家长教孩子认汉字或拼音的次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

36) 家长教孩子读诗（唐诗，宋词），儿歌或歌曲的次数是：(请选择合适的频率)：

①每天; ②一周 3-4 次; ③一周 1-2 次; ④一个月多次; ⑤一个月 1-2 次; ⑥很少; ⑦从不

在您的孩子进入小学前的这段时间里，我们将会对他（她）的入学准备状态进行追踪观察，为方便向您反馈孩子的发展状况，您知道孩子进入那所小学？

____

为方便以后追踪调查，请否您的联系方式：_______镇______村；电话：_______；

姓名 _______

让我们共同关注孩子的健康成长！感谢参与！

Appendix III. Parent/Guardian Questionnaire (Phase 2)

[English Version]

How often has index child?

(7=Everyday; 6=Several times a week; 5=Once or twice a week; 4=Several times a month; 3=Once or twice a month; 2=Less often; 1=Never)

Played with friends at home: 1 2 3 4 5 6 7

Generally, what kinds of activities did they play with?

Played with friends elsewhere: 1 2 3 4 5 6 7

Do you know what kinds of activities did they usually play with?

Gone on visits to friends or relatives: 1 2 3 4 5 6 7

Gone shopping with parents or others: 1 2 3 4 5 6 7

Watching TV/videos: 1 2 3 4 5 6 7

Generally, what kinds of TV/Video programs did index child watch? (Program name)

Reading at home 1 2 3 4 5 6 7

Generally, what kinds of books did index child read? Book's name….

Painting or drawing at home 1 2 3 4 5 6 7

Generally, what contents did index child paint or draw?

Writing 1 2 3 4 5 6 7

Generally, what did index child writing about?

Counting/playing with numbers 1 2 3 4 5 6 7

If yes, what have you taught and how to teach (relating shapes, colour, or time…..)

Playing with numbers/Chinese Characters/Pinyin 1 2 3 4 5 6 7

Generally, how did index child play with numbers/Chinese characters/Pinyin?

How many books does index child have at home (other than kindergarten textbook).

1) none； 2）1-2； 3）3-5； 4）6-9； 5）10 and more

Has index child suffered from any illness in the last six months?

1) colds 2) coughs 3) breathing difficulties 4) vomiting 5) diarrhoeas 6) listlessness 7) loss of appetite 8)temperature 9) convulsions 10) rash

11) any other illness_______________

How is index child's health status?

1) Excellent 2) very good 3) good 4) fair 5) poor

What's the income of the family per year? (Chinese Yuan)

Less than10, 000; 10,000-30,000; 30,000--50,000; 50,000-80,000; More than 80, 000

Could we have a name, address and phone number of a close relative in case you move and we need to get in touch? This is index child's ……… (Grandparent, aunts? etc)

Address: ___________Town, __________Village; Telephone number: _______________

Name (Sign here):

Thank you for your time. I hope you find the interview interesting

[Chinese Version]

你（或家人）给孩子阅读（或讲故事）的次数是：(请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

你（或家人）教孩子算数/数数的次数是：(请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

你（或家人）教孩子认（写）汉字（或拼音）的次数是: (请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

孩子在家画画的次数是：(请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

孩子和其它小朋友在家里玩耍的次数是: (请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

孩子和其他小朋友在外面玩耍的次数是: (请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

孩子和家长一起走亲戚（或拜访朋友）的次数是: (请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；

孩子和家长一起外出购物（比如逛商场，赶集市）的次数是：(请选择合适的频率）

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；

家中的儿童读物（比如儿童图画书，故事书等）大概有几本？（不包含幼儿园用书）(请选择合适的频率）

1 没有；2）1-2 本；3）3-5 本；4）6-9 本；5）10 本及以上

孩子在家看电视（或 DVD）的次数是：

1）从不；　2）很少；　3）几个月一次；4）每月 1-2 次；5）每周 1-2 次；6）一周多次；7）每天

孩子在过去 6 个月的时间有没有以下症状？ 1）无；　2）有（有的话请在下面标出）

----感冒；-----发烧；----咳嗽；----呼吸困难；----呕吐； -----生疹子；-----腹泻；------食欲不振；--------无精打采；

-----痉挛； 其它病症（如有请写出）____

你认为孩子在过去 6 个月的身体状况是：

1）很好； 3） 好； 4）一般； 5）较差； 6）很差

您的家庭年收入大约为：

1）低于 1 万元；　2）1-3 万；　3） 3-5 万；　4）5-8 万； 5）8 万以上

感谢您的孩子参与到“儿童入学准备研究”中，为方便我们及时向家长反馈孩子的入学准备信息，请您务必留下最近新的联系方式：家庭住址:_______ 镇 _______村； 联系电话：_________家长签名：______________________

让我们共同关注孩子的健康成长！ 感谢参与！

Appendix IV. Preschool Quality Measures

Overview of the Subscales and Items of ECERS-R

Space and Furnishings 1. Indoor space 2. Furniture for routine care, play and learning 3. Furnishings for relaxation and comfort 4. Room arrangement for play 5. Space for privacy 6. Child-related display 7. Space for gross motor play 8. Gross motor equipment **Personal Care Routines** 9. Greeting/departing 10. Meals/snacks 11. Nap/rest 12. Toileting/diapering 13. Health practices 14. Safety practices **Language-Reasoning** 15. Books and pictures 16. Encouraging children to communicate 17. Using language to develop reasoning skills 18. Informal use of language **Activities** 19. Fine motor 20. Art 21. Music/movement 22. Blocks 23. Sand/water 24. Dramatic play 25. Nature/science 26. Math/number 27. Use of TV, video, and/or computers 28. Promoting acceptance of diversity	**Interaction** 29. Supervision of gross motor activities 30. General supervision of children (other than gross motor) 31. Discipline 32. Staff-child interactions 33. Interactions among children **Program Structure** 34. Schedule 35. Free play 36. Group time 37. Provisions for children with disabilities **Parents and Staff** 38. Provisions for parents 39. Provisions for personal needs of staff 40. Provisions for professional needs of staff 41. Staff interaction and cooperation 42. Supervision and evaluation of staff 43. Opportunities for professional growth

Source: Harms, T., Clifford, R. M., & Cryer, D. (1998). *Early Childhood Environment Rating Scale-Revised Edition*. New York, NY: Teachers College Press.

Overview of the Subscales and Items of ECERS-E

Literacy Items 1-6 1 Print in the environment; 2 Book and literacy areas; 3 Adult reading with the children; 4Sounds in words; 5. Emergent writing/mark making; 6. Talking and listening **Mathematics Items 7-9b** 7 Counting and the application of counting 8 Reading and representing simple numbers 9a Mathematical activities: Shape (select either 9a or 9b) 9b Mathematical activities: Sorting, matching and comparing	**Science and Environment Items 10-12c** 10 Natural materials 11 Areas featuring science/science resources 12 a Science activities: Non-living(Select either 12a, 12b, or 12c) 12b Science activities: Living processes and the world around us 12c Science activities: Food preparation **Diversity Items 13-15** 13 Planning for individual learning needs 14 Gender equality and awareness 15 Race equality

Source: Sylva, K., Siraj-Blatchford, I, & Taggart, B. (2003). *Assessing Quality in the Early Years: Early Childhood Environment Rating Scale-Extension (ECERS-E).* Stoke-on Trent, England: Trentham Books.

Appendix V. Cognitive Measures

Overview of the Bracken Basic Concept Scale-Revised

BBCS-R Subscale	Descriptions	Note
Colours	Represents both primary colours and basic colour terms.	
Letters	measures knowledge of both upper- and lowercase letters	N/A*
Numbers/Counting	Measures recognition of single- and double-digit numbers and samples the ability to assign a number value to a set of objects.	
Sizes	Includes concepts that describe one, two, and three dimensions.	
Comparisons	Measures ability to match and/or differentiate objects based on one or more of their salient characteristics.	
Shapes	Includes one-, two-, and three-dimensional shapes. The one-dimensional category includes linear shapes; two dimensional shapes are represented by concepts such as the circle, square, and triangle; and three-dimensional shapes include concepts such as the cube and pyramid.	
Direction/Position	Includes relational terms that describe the placement of one object relative to another, the position of an object relative to itself or an unspoken second object, or a direction of placement.	
Self-/Social Awareness	Represents a conceptual domain measured infrequently by preschool and primary language scales. Included in the self-awareness aspect are concepts with emotional value, while the social awareness aspect includes terms describing kinship, gender, relative ages, and social appropriateness.	
Texture/Material	Includes terms that describe salient characteristics or attributes or the basic composition of an object.	
Quantity	Measures understanding of terms that describe a relative degree of existence.	
Time/Sequence	Measures understanding of occurrences along a temporal or sequential continuum and the degree of speed and/or order with which those events occur on the continuum	

Note: *N/A not applicable in Chinese context；

***Source*：** Bracken, B. A. (1998). *Bracken Concept Scale-Revised Examiner's Manual*. San Antonio, TX: The Psychological Corporation (*p*13-14).

Overview of the Wechsler Intelligence Scale for Children® — Fourth Edition

The following shows the three indexes of the WISC-IV used in this study and what they measure

Verbal Comprehension Index (VCI)	Measure: Verbal concept formation. It assesses children's ability to listen to a question, draw upon learned information from both formal and informal education, reason through an answer, and express their thoughts aloud. It can tap preferences for verbal information, a difficulty with novel and unexpected situations, or a desire for more time to process information rather than decide "on the spot." Note: This index is a good predictor of readiness for school and achievement orientation, but can be influenced by background, education, and cultural opportunities.
Perceptual Reasoning Index (PRI)	Measure: Non-verbal and fluid reasoning. It assesses children's ability to examine a problem, draw upon visual-motor and visual-spatial skills, organize their thoughts, create solutions, and then test them. It can also tap preferences for visual information, comfort with novel and unexpected situations, or a preference to learn by doing.
General Ability Index (GAI)	The GAI is a composite score that is based on 3 Verbal Comprehension and 3 Perceptual Reasoning subtests, and does not include the Working Memory or Processing Speed subtests included in the Full Scale IQ (FSIQ). The WISC–IV GAI provides the practitioner a summary score that is less sensitive to the influence of working memory and processing speed.

Note: The WISC-IV contains 10 core subtests and 5 additional subtests. These are summed to four indexes (the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI) and the Processing Speed Index (PSI) and one Full Scale IQ (FSIQ) which ranges from lowest 40 to highest 160 points. Due to the research design, the current study only used Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), and their combing scores General Ability Index (GAI). ***Source:*** http://www.pearsonclinical.com/psychology/products/100000310/wechsler-intelligence-scale-for-children-fourth-edition-wisciv.html?Pid=015-8979-044#tab-resources

Appendix VI. Strength and Difficulties Questionnaire (T/P)

[English Version]

Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

Child's Name .... Male/Female

Date of Birth..

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children (treats, toys, pencils etc.)	☐	☐	☐
Often has temper tantrums or hot tempers	☐	☐	☐
Rather solitary, tends to play alone	☐	☐	☐
Generally obedient, usually does what adults request	☐	☐	☐
Many worries, often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, down-hearted or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often lies or cheats	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Thinks things out before acting	☐	☐	☐
Steals from home, school or elsewhere	☐	☐	☐
Gets on better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Sees tasks through to the end, good attention span	☐	☐	☐

Signature .... Date ....

Parent/Teacher/Other (please specify:)

Thank you very much for your help

[Chinese Version]

長處和困難(家長/老師版本)

對於下面的各個題，請在相應的格上劃勾，以表明是否符合這名學童的情況 – 是「不符合」，「有點符合」，還是「完全符合」。請根據這孩子過去六個月或這學年的行為來回答。 請務必回答每一道題， 即使你對某一題不是十分確定。

孩子的名字: .... 男／女

出生日期:..

	不符合	有點符合	完全符合
能體諒到別人的感受	☐	☐	☐
不安定、過分活躍、不能長久靜止	☐	☐	☐
經常抱怨頭痛、肚子痛或身體不舒服	☐	☐	☐
很樂意與別的小孩分享東西(糖果、玩具、筆、等等)	☐	☐	☐
經常發脾氣或大吵大鬧	☐	☐	☐
頗孤獨，比較多自己玩	☐	☐	☐
一般來說比較順從，通常是成年人要求要做的都肯做	☐	☐	☐
有很多擔憂，經常表現出憂慮	☐	☐	☐
如果有人受傷、不舒服或是生病，都很樂意提供幫助	☐	☐	☐
當坐著時，會持續不斷地擺弄手腳或扭動身子	☐	☐	☐
至少有一個好朋友	☐	☐	☐
經常與別的小孩吵架或欺負他們	☐	☐	☐
經常不高興、情緒低落或哭泣	☐	☐	☐
一般來說，受別的小孩所喜歡	☐	☐	☐
容易分心，注意力不集中	☐	☐	☐
在新的情況下，會緊張或愛黏人，容易失去信心	☐	☐	☐
對年紀小的小孩和善	☐	☐	☐
經常撒謊或欺騙	☐	☐	☐
受別的小孩作弄或欺負	☐	☐	☐
經常自願的幫助別人(父母、老師或其他小孩)	☐	☐	☐
做事前會想清楚	☐	☐	☐
會從家裡、學校或其他地方偷東西	☐	☐	☐
跟成年人相處比跟小孩相處融洽	☐	☐	☐
對很多事物感到害怕，容易受驚嚇	☐	☐	☐
做事情能做到底，注意力持久	☐	☐	☐

簽名: .... 日期: ....

家長/老師/其他 (請註明):

多謝你的幫忙！

[Extra Items]

	Not True	*Somewhat True*	*Certainly True*
Calm and easy going	☐	☐	☐
Likes to work things out for self; seeks help only when has to, or as last resort;	☐	☐	☐
Shows wide mood swings;	☐	☐	☐
Can work or play easily with others	☐	☐	☐
Does not need much help with tasks	☐	☐	☐
Gets over excited	☐	☐	☐
Says 'please' and 'thank you' when reminded	☐	☐	☐
choose activities on their own	☐	☐	☐
Easily frustrated	☐	☐	☐
Gets over being upset quickly	☐	☐	☐
Persists in the face of difficult task	☐	☐	☐
Waits his/her turn in games or activities	☐	☐	☐
Cooperates with request	☐	☐	☐
Can move to a new activity after finishing a task	☐	☐	☐
Impulsive, acts without thinking	☐	☐	☐

Appendix VII. Frequency Distribution for Home Activities

Preschool (Phase 1)

Home activities	1	2	3	4	5	6	7
Play with friends at home	0%	6.5%	1.8%	10.5%	18.0%	23.5%	39.7%
Play with friends elsewhere	0%	11.9%	5.4%	14.1%	26.4%	21.7%	20.6%
Eating with family	0%	4.3%	0.4%	5.1%	1.4%	1.8%	87.0%
Visiting relatives	0.4%	20.3%	31.2%	20.7%	25.0%	2.2%	0.4%
Go Shopping	0%	17.8%	26.1%	18.5%	25.4%	10.1%	2.2%
Watching TV	1.4%	15.6%	4.7%	7.2%	14.5%	16.7%	39.9%
Reading at home	1.8%	22.1%	3.3%	9.8%	20.7%	21.4%	21.%
Drawing at home	0.4%	14.1%	2.5%	9.8%	25.0%	24.3%	23.9%
Writing at home	0.7%	13.4%	2.5%	10.5%	21.0%	24.6%	27.2%
Play with numbers	2.2%	32.6%	6.9%	8.7%	21.4%	14.5%	13.8%
Be Reading	1.1%	24.3%	9.1%	13.4%	23.6%	18.8%	9.8%
Teaching drawing	2.9%	34.8%	8.3%	8.7%	27.2%	11.6%	6.5%
Teaching writing	0.4%	21.0%	3.3%	13.4%	26.1%	18.1%	17.8%
Teaching counting	0.4%	17.0%	5.4%	8.3%	23.2%	25.7%	19.9%
Teaching Chinese characters	1.1%	26.1%	5.4%	8.7%	25.7%	18.8%	14.1%
Teaching poems and rhythm	1.1%	31.5%	10.9%	14.1%	24.3%	10.9%	7.2%

School Entry (Phase 2)

Home activities	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Reading stories	2.1%	26.6%	3.4%	17.6%	27.5%	16.3%	6.4%
Counting activities	.9%	6.4%	1.7%	5.2%	21.0%	39.1%	25.8%
Teaching Chinese	1.3%	11.2%	1.7%	5.2%	21.0%	33.0%	26.6%
Drawing activities	.0%	17.7%	2.2%	9.5%	27.2%	30.2%	13.4%
Playing with friends	.4%	6.5%	5.6%	0%	15.1%	32.3%	40.1%
Visiting activities	.4%	23.6%	13.7%	33.5%	21.9%	6.9%	/
Go shopping	.4%	15.0%	5.2%	33.0%	35.2%	11.2%	/

Note: 1= Never; 2= Less often; 3= Once or twice a month; 4= Several times a month; 5= Once or twice a week; 6= Several times a week; 7= Everyday

Appendix VIII. Factor Analysis of Home Activities

Preschool (Phase 1)

Total Variance Explained. *(Extraction Method: Principal Component Analysis).*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.337	35.207	35.207	6.337	35.207	35.207	5.295	29.414	29.414
2	1.816	10.087	45.294	1.816	10.087	45.294	1.941	10.781	40.195
3	1.423	7.904	53.199	1.423	7.904	53.199	1.859	10.328	50.523
4	1.077	5.982	59.181	1.077	5.982	59.181	1.558	8.658	59.181

Rotated Component Matrix[a]

	Component			
	Learning activities	Family activities	Peer activity	Regularity
Regular sleeping time	.071	-.007	-.030	.786
Regular TV watching	.131	-.021	.006	.778
Play with friends at home	.078	.211	.721	-.036
Play with friends elsewhere	.103	.262	.645	.281
Eating with family	.149	-.006	.699	-.189
Visiting relatives	.252	.645	.148	.061
Go shopping	.196	.796	.075	.068
Watching TV	.037	.673	.187	-.144
Reading at home	.576	.270	.289	.234
Drawing at home	.474	.181	.374	.116
Writing at home	.720	-.019	.310	.092
Play with numbers	.633	.237	.139	.203
Be reading	.707	.215	.134	.155
Teaching drawing	.760	.238	.027	.046
Teaching writing	.838	.067	.033	-.061
Teaching counting	.832	-.030	.096	-.083
Teaching Chinese characters	.852	.053	.003	.020
Teaching poem at home	.676	.221	.052	.188
a. Rotation converged in 5 iterations.				

School Entry (Phase 2)

Total Variance Explained. *(Extraction Method: Principal Component Analysis).*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.678	38.258	38.258	2.678	38.258	38.258	1.884	26.917	26.917
2	1.155	16.503	54.761	1.155	16.503	54.761	1.510	21.577	48.494
3	1.027	14.678	69.440	1.027	14.678	69.440	1.466	20.945	69.440

Rotated Component Matrix[a].

	Component		
	Parental teaching	Individual learning	Family activities
Reading	.505	.562	.054
Counting	.891	.133	.112
Teaching Chinese characters	.883	.099	.151
Drawing activities	.022	.802	.083
Visiting friends & relatives	.177	.099	.821
Go shopping	.059	.119	.855

Books	.146	.708	.130
a. Rotation converged in 5 iterations.			

Appendix IX. Frequency Distribution on the ECERS-R and ECERS-E

ECERS-R scores

Score	ECERS-R	Space & Furnishing	Personal care Routines	Language Reasoning	Activities	Interaction	Programme Structure	Parents & Staff
2	16.8%	25.5%	5.7%	12.1%	31.9%	6.4%	50.3%	16.8%
3	54.3%	43.6%	46.3%	40.9%	51.7%	39.6%	49.7%	30.5%
4	28.9%	22.2%	31.6%	47%	16.4%	39.9%		44.0%
5		8.7%	6.4%			14.1%		8.7%

ECERS-E scores

Score	ECERS-E	Literature	Math	Science	Diversity
1					40.9%
2	28.9%	6.4%		34.6%	42.7%
3	49.6%	39.1%	8.4%	26.1%	16.4%
4	21.5%	38.6%	72.8%	30.6%	
5		16.4%	18.8%	8.7%	

Appendix X. Frequency Distribution on the SDQ

Teacher SDQ for Sample Children (Mean Age 69 Months)

Emotional symptoms score

Score	Total (N=298)		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	52.3	52.3	49.6	49.6	55.1	55.1
1	27.8	80.1	31.7	81.3	23.6	78.7
2	9.4	89.5	10.8	92.1	7.9	86.6
3	6.4	95.9	4.3	96.4	8.7	95.3
4	3.0	98.9	2.2	98.6	3.9	99.2
5	.8	99.6	.7	99.3	.8	100
6-7	.4	100	.7	100		

Conduct problems score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	33.6	33.6	39.6	39.6	27.0	27.0
1	49.1	82.6	47.5	87.1	50.8	77.8
2	10.6	93.2	7.9	95.0	13.5	91.3
3	3.8	97.0	2.2	97.1	5.6	96.8
4	1.9	98.9	.7	97.8	3.2	100
5	.4	99.2	.7	98.6		
6	.4	99.6	.7	99.3		
7	.4	100	.7	100		

Hyperactivity score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	22.2	22.2	26.6	26.6	17.3	17.3
1	10.9	33.1	12.2	38.8	9.4	26.8
2	26.3	59.4	30.9	69.8	21.3	48.0
3	12.0	71.4	10.1	79.9	14.2	62.2
4	10.9	82.3	7.2	87.1	15.0	77.2
5	8.3	90.6	3.6	90.6	13.4	90.6
6	3.0	93.6	2.2	92.8	3.9	94.5
7	1.9	95.5	2.2	95.0	1.6	96.1
8	3.4	98.9	2.9	97.8	3.9	100
9	.8	99.6	1.4	99.3		
10	.4	100	.7	100		

Peer problems score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	16.5	16.5	16.5	16.5	16.5	16.5
1	30.5	47.0	33.1	49.6	27.6	44.1
2	22.9	69.9	23.7	73.4	22.0	66.1
3	16.9	86.8	12.2	85.6	22.0	88.2
4	10.5	97.4	11.5	97.1	9.4	97.6
5	1.9	99.2	1.4	98.6	2.4	100
6	.4	99.6	.7	99.3		
7	.4	100	.7	100		

Prosocial behaviour score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
1	1.1	1.1			2.4	2.4
2	.4	1.5			.8	3.1
3	.8	2.3	.7	.7	.8	3.9
4	4.9	7.1	2.2	2.9	7.9	11.8
5	17.3	24.4	13.7	16.5	21.3	33.1
6	14.7	39.1	12.9	29.5	16.5	49.6
7	13.9	53.0	15.8	45.3	11.8	61.4
8	16.5	69.5	15.1	60.4	18.1	79.5
9	12.8	82.3	13.7	74.1	11.8	91.3
10	17.7	100	25.9	100	8.7	100

Parent SDQ for Sample Children (Mean Age 80 Months)

Emotional symptoms score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0-1	43.9	43.9	42.2	42.2	45.6	45.6
2	32.6	76.4	30.3	72.5	35	80.6
3	19.8	96.2	22.0	94.5	17.5	98.1
4-5	2.8	99.1	3.7	98.2	1.9	100
6-7	.9	100	1.8	100		

Conduct problems score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	22.2	22.2	22.0	22.0	22.3	22.3
1	48.6	70.8	51.4	73.4	45.7	68.0
2	18.4	89.2	13.8	87.2	23.3	91.3
3	1.9	91.0	1.8	89.0	1.9	93.2
4	5.2	96.2	6.4	95.4	3.9	97.1
5	1.8	98.1	1.8	97.2	1.9	99.0
6	.9	99.0	1.8	99.1		
7-10	1.0	100	.9	100	1	100

Hyperactivity score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	7.5	7.5	9.2	9.2	5.8	5.8
1	18.4	25.9	19.3	28.4	17.5	23.3
2	23.1	49.1	26.6	55.0	19.4	42.7
3	11.3	60.4	11.9	67.0	10.7	53.4
4	14.6	75.0	9.1	76.1	20.4	73.8
5	9.9	84.9	9.2	85.3	10.7	84.5
6	6.1	91.0	8.3	93.6	3.9	88.3
7	5.2	96.2	4.6	98.2	5.9	94.2
8	1.9	98.1	.9	99.1	2.9	97.1
9	1.4	99.5	.9	100	1.9	99.0
10	.5	100			1.0	100

Peer problems score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0-2	8.0	8.0	7.3	7.3	8.7	8.7
3	39.6	47.6	38.5	45.9	40.8	49.5
4	30.7	78.3	34	79.8	27.2	76.7
5	16.5	94.8	17.4	97.2	15.5	92.2
6	4.2	99.0	2.8	100	5.9	98.1
7	1.0	100			1.9	100

Prosocial behaviour score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
1	.5	.5	.9	.9		
2	.9	1.4	.9	1.8	1.0	1.0
3-4	.5	1.9			.9	1.9
5	8.0	9.9	10.1	11.9	5.9	7.8
6	14.6	24.5	18.4	30.3	10.6	18.4
7	22.2	46.7	20.2	50.5	24.3	42.7
8	16.0	62.7	11.0	61.5	21.4	64.1
9	20.8	83.5	21.1	82.6	20.4	84.5
10	16.5	100	17.4	100	15.5	100

Behaviour regulation score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
1-2	1.4	1.4	1.9	1.9	1.0	1.0
3	2.9	4.3	1.9	3.8	3.9	4.9
4	5.3	9.6	3.7	7.5	6.9	11.8
5	19.6	29.2	23.4	30.8	15.7	27.5
6	16.3	45.5	18.7	49.5	13.7	41.2
7	19.6	65.1	17.8	67.3	21.6	62.7
8	15.8	80.9	16.8	84.1	14.8	77.5
9	12.4	93.3	10.3	94.4	14.7	92.2
10	6.7	100	5.6	100	7.8	100

Cooperation score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
2	1.4	1.4	.9	.9	2.0	2.0
3	1.4	2.9	1.9	2.8	1.0	2.9
4	3.8	6.7	2.8	5.6	4.9	7.8
5	13.9	20.6	14.0	19.6	13.7	21.6
6	14.8	35.4	19.6	39.3	9.8	31.4
7	14.8	50.2	12.1	51.4	17.6	49.0
8	19.1	69.4	17.8	69.2	20.6	69.6
9	20.6	90.0	17.8	86.9	23.5	93.1
10	10.0	100	13.1	100	6.9	100

Emotional dysregulation score

Score	Total		Girl		Boy	
	%	Cumul %	%	Cumul %	%	Cumul %
0	18.2	18.2	18.7	18.7	17.6	17.6
1	21.5	39.7	21.5	40.2	21.6	39.2
2	21.1	60.8	22.4	62.6	19.6	58.8
3	11.0	71.8	9.3	72.0	12.8	71.6
4	11.5	83.3	12.1	84.1	10.8	82.4
5	8.6	91.9	7.5	91.6	9.8	92.2
6	5.3	97.1	6.5	98.1	3.9	96.1
7	1.9	99.0	1.9	100	1.9	98.0
8	.5	99.5			1.0	99.0
9	.5	100			1.0	100

Appendix XI. Correlations of Child, Parents, Preschool Characteristics, and Home Activities with Cognitive Outcomes

	Cognitive outcomes				
	Phase 1		*Phase 2*		
Variables	*SRC*	*GCA*	*VCI*	*PRI*	*GAI*
Demographic characteristics					
Girl	.18**	.12*	-.05	-.09	-.09
Single child	-.02	-.06	-.02	-.02	-.03
Birth order	.01	-.09	.02	.03	-.01
Birth weight (g)	.05	.03	.02	-.06	-.03
Family income	.16**	.13*	.16*	.14*	.18 **
Paternal education	.17**	.12+	.24***	.15*	.22***
Maternal education	.10	.07	.19**	.05	.12+
Age of attendance	-.12+	-.11+	-.13*	-.13*	-.17**
Changing preschools	.02	-.05	.14*	-.04	.03
Mother's age at child' birth	.01	-.07	.01	-.08	-.06
Home activities					
Phase 1					
Learning activities	-.03	-.14*	-.01	-.12+	-.08
Family activities	.12+	.14*	.13*	.12+	.16*
Peer social	.15*	.14*	.09	.06	.09
Regularity	.06	.06	.04	.13*	.11+
Phase 2					
Parent teaching	/	/	.06	.01	.03
Individual learning	/	/	.09	.10	.12+
Family activities	/	/	.07	.04	.07

	Cognitive outcomes				
	Phase 1		*Phase 2*		
Variables	*SRC*	*GCA*	*VCI*	*PRI*	*GAI*
Preschool characteristics					
Classroom size	.15*	$.12^{+}$	$.12^{+}$	.13*	.15*
Staff: child ratio	-.09	.02	-.08	-.08	$-.10^{+}$
Teachers' experiences	-.01	.08	-.06	-.02	-.05
Teachers' qualification	.35***	.32***	.25***	.17**	.25***
ECERS-R overall score	.38***	.34***	.26***	.18**	.25***
Space & furniture	.36***	.32***	.25***	.16**	.24***
Personal care routines	.33***	.31**	.21***	.15*	.21***
Language reasoning	.31***	.30***	.21***	.13*	.19***
Activities	.34***	.29***	.25***	.17**	.25***
Interactions	.29***	.30***	.18**	$.12^{+}$	.17**
Programme structure	.28***	.28***	.21***	.15*	.21**
Parents & staff	.39***	.29***	.28 ***	.20**	.28***
ECERS-E overall score	.39***	.33***	.27***	.20**	.28 ***
Literature	.38***	.31***	.26 ***	.18**	.26***
Math	.37***	.35***	.26 ***	.23***	.30***
Science	.39***	.29***	.28***	.18**	.27***
Diversity	.32***	.27***	.21***	.17**	.22***

Note: $^{+}p<.10$, $*p<.05$, $**p<.01$, $***p<.001$; *SRC:* School readiness based on the Bracken Basic Concept Scales-Revised (BBCS-R) School Readiness Composite; *GCA:* General cognitive ability based on the BBCS-R; VCI: Verbal ability based on the WISC-Verbal Comprehension Index; PRI: Non-verbal ability based on the WISC-Perceptual Reasoning Index; GAI: General cognitive ability based on the WISC-General Ability Index.

Appendix XII. Summary of ECERS-R and ECERS-E Subscale Predictors

	Cognitive development									
	Phase 1				Phase 2					
Predictor variable	SRC		GCA		VCI		PRI		GAI	
	B	***SE***	***B***	***SE***	***B***	***SE***	***B***	***SE***	***B***	***SE***
ECERS-R										
Space and Furnishings	.31**	.11	.25*	.11	.18**	.07	.09	.07	.15+	.08
Personal Care Routines	.30**	.11	.29**	.10	.17*	.07	.11	.07	.15+	.08
Language-Reasoning	.21*	.09	.22*	.09	.15*	.07	.10	.07	.158	.07
Activities	.29**	.10	.21*	.11	.17*	.07	.10	.07	.15+	.08
Interactions	.19*	.09	.21*	.09	.13+	.07	.11	.07	.15*	.07
Program Structure	.23*	.11	.26*	.10	.15*	.07	.10	.07	.15*	.07
Parents and Staff	.33***	.09	.21*	.11	.20**	.07	.13+	.07	.18*	.07
ECERS-E										
Literature	.33***	.09	.28**	.10	.17*	.07	.12+	.07	.17*	.07
Math	.35***	.10	.25*	.10	.19**	.07	.17**	.07	.21**	.07
Science	.33***	.09	.33***	.09	.19**	.07	.11	.07	.16*	.07
Diversity	.22*	.10	.21*	.10	.15*	.07	.1027	.07	.13+	.08

Note: +*p*<.10, **p*<.05, ***p*<.01, ****p*<.001; SRC: School readiness based on the Bracken Basic Concept Scales-Revised (BBCS-R) School Readiness Composite; GCA: General cognitive ability based on the BBCS-R; VCI: Verbal ability based on the WISC-Verbal Comprehension Index; PRI: Non-verbal ability based on the WISC-Perceptual Reasoning Index; GAI: General cognitive ability based on the WISC-General Ability Index.

Appendix XIII. Progress Models with School Readiness (Phase 1) as Predictor variable for Cognitive Outcomes at School Entry (Phase 2)

Progress models	*B*	*SE*	AIC	ΔAIC
Verbal ability (VCI)			*796.55*	*24.46*
Intercept	.45***	.12		
Paternal education (secondary school or below)	-.35**	.13		
Stability (not changing preschools)	-.31	.12		
ECERS-R	.08	.06		
School readiness (SRC)	.33***	.06		
Non-verbal ability (PCI)			*800.01*	*35.18*
Intercept	.29*	.12		
Family income (less than 30K)	-.22*	.11		
Paternal education (secondary school or below)	-.25+	.13		
ECERS-E	.01	.06		
School Readiness (SRC)	.37***	.06		
General cognitive ability (GAI)			*765.41*	*51.98*
Intercept	.36**	.12		
Paternal education (secondary school or below)	-.34**	.13		
Family income (less than 30K)	-.23*	.11		
ECERS-E	.04	.06		
School readiness (SRC)	.43	.06		

Note: +p<.10, *p<.05, **p<.01, ***p<.001; SRC: School readiness based on the Bracken Basic Concept Scales-Revised (BBCS-R) School Readiness Composite; VCI: Verbal ability based on the WISC-Verbal Comprehension Index; PRI: Non-verbal ability based on the WISC-Perceptual Reasoning Index; GAI: General cognitive ability based on the WISC-General Ability Index.

Appendix XIV. Correlations of Child, Parents, Preschool Characteristics, Home Activities, with Social Outcomes at Preschool

Variables	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour
Sample characteristics					
Age in month	-.12^{+}	-.03	-.07	-.09	.06
Girl	-.01	-.11^{+}	-.15*	.03	.26***
Only child	-.05	.02	.06	-.07	-.01
Birth weight	-.17**	-.09	-.17**	-.08	.12^{+}
Family income	-.05	-.03	.04	-.13*	.05
Paternal education	-.03	-.10^{+}	-.06	-.03	.06
Maternal education	.03	.02	.04	-.10^{+}	.04
Age of starting preschool	-.01	-.01	.01	.05	.02
Changing preschools	.07	-.06	.04	-.01	-.01
Mother's age at child birth	.03	.08	.04	.10^{+}	-.04
Home activities (Phase 1)					
Learning activities	.05	-.03	-.02	-.04	-.03
Family activities	.03	-.01	.01	-.11^{+}	.06
Peer social	-.03	.04	-.07	-.20**	.03
Regularity	.10^{+}	.02	-.02	.05	-.01

Variables	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour
Preschool characteristics					
Classroom size	-.03	.03	.01	.06	.06
Staff: child ratio	.08	-.12+	-.05	.01	.11+
Teachers' qualification	.04	.05	-.04	-.03	.06
Teachers' experience	-.04	.07	-.01	.16**	-.21**
ECERS-R	-.03	-.01	-.13*	-.20**	.17**
Space & furnishing	-.05	-.01	-.11+	-.09	.14 *
Personal routines	-.02	-.03	-.04	-.19**	.12+
Language reasoning	.05	-.06	-.10+	-.19**	.17 **
Activities	-.08	.03	-.11+	-.18**	.15*
Interactions	-.01	-.06	-.18**	-.25***	.13*
Programme structure	.04	-.06	-.10+	-.16**	.13*
Parents & staff	-.06	.04	-.10+	-.19**	.22***
ECERS-E	-.02	-.02	-.11+	-.16**	.27***
Literature	-.04	-.04	-.16**	-.20**	.28***
Math	.04	.03	-.02	-.16**	.18**
Science	-.04	-.04	-.16**	-.13*	.34***
Diversity	.01	-.01	-.03	-.11+	.18**

Note: +p<.10, *p<.05, **p<.01, ***p<.0

Appendix XV. Correlations of Child, Family and Preschool Characteristics, Home activities, with Social Outcomes at School Entry

Variables	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour	Behaviour regulation	Cooperation	Emotional dysregulation
Child, family characteristics								
Age	-.17*	-.07	-.08	.04	.03	.14*	.08	-.11
Age of attendance	.04	.01	-.04	-.02	-.10	.00	-.06	.04
Girl	.09	.00	-.11	-.02	-.06	-.06	.01	-.03
Single child	.06	.09	.20**	.01	-.03	-.10	-.07	.09
Birth weight	.03	.08	$-.12^{+}$	-.04	-.08	$-.12^{+}$	-.05	.01
Family Income	-.11	-.01	-.07	-.03	.07	$.13^{+}$	.04	-.08
Paternal education	.04	.03	.09	-.03	.05	.06	-.06	.10
Maternal education	.04	.10	.11	-.04	.03	-.01	-.06	.09
Changing preschools	-.07	-.01	-.02	-.07	.09	.02	.10	-.02
Mother’s age at child’s birth	-.03	-.05	-.09	.01	.06	.06	.04	.00

Variables	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour	Self-regulation	Cooperation	Emotional dysregulation
***Home activities** (Phase 1)*								
learning activities	.02	-.20**	-.18*	.03	.14*	.20**	.16*	-.10
Family activities	-.05	.07	-.00	-.04	.08	.02	-.04	-.05
Peer activities	.05	-.06	.02	-.09	.20**	.10	.13*	-.06
Regularity	-.07	-.14*	-.13*	-.01	.21**	.16*	.14*	-.09
***Home activities** (Phase 2)*								
Parent teaching	.03	-.10	-.03	.07	.09	.09	.07	-.03
Individual learning	-.23**	-.16*	-.22**	-.03	.11	.21**	.18*	-.14*
Family activities	-.17*	-.08	-.13*	-.10	.11	.03	.01	-.14*
Preschool characteristics								
Staff: child ratio	.01	-.01	.05	.04	-.06	-.08	-.07	.11
Teachers' experience	-.02	.03	.02	.10	-.05	-.00	-.03	.11
Teachers' qualification	-.04	-.08	-.02	-.11	.10	$.13^{+}$	.02	-.03

Variables	Emotional symptoms	Conduct problems	Hyperactivity	Peer problems	Prosocial behaviour	Self- regulation	Cooperation	Emotional dysregulation
Classroom size	-.08	.00	.02	-.02	.07	.08	-.07	-.06
ECERS-R	-.09	-.11	-.11	-.13^{+}	.09	.10	.08	-.09
Space & furnishing	-.10	-.09	-.09	-.11^{+}	.11	.09	.07	-.11
Personal routines	-.08	-.13^{+}	-.14*	-.11	.08	.05	.07	-.11
Language reasoning	-.05	-.11	-.07	-.07	-.02	.02	.02	.00
Activities	-.14*	-.11	-.10	-.13^{+}	.14*	.13^{+}	.09	-.08
Interactions	-.05	-.11+	-.14 *	-.08	.03	.07	.07	-.04
Programme structure	-.09	-.14*	-.15*	-.12^{+}	.07	.11^{+}	.12^{+}	-.13^{+}
Parents & staff	-.12	-.02	-.05	-.13^{+}	.08	.12^{+}	.07	-.07
ECERS-E	-.09	-.05	-.04	-.12^{+}	.08	.11	.07	-.05
Literature	-.08	-.08	-.07	-.12^{+}	.09	.11	.07	-.06
Math	-.12^{+}	-.12^{+}	-.07	-.12^{+}	.15*	.14*	.11	-.07
Science	-.08	.00	-.03	-.12^{+}	.06	.12^{+}	.05	-.06
Diversity	-.03	.01	.01	-.07	.04	.05	.03	.03

Note: ^{+}p<.10, **p*<.05, ***p*<.01, ****p*<.001.